SOME JAVA P. O. J. SEEDLINGS IN TUCUMÁN AND PORTO RICO *

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Despite the marvelous advances in scientific agriculture in the past quarter century the extension and usefulness of imported varieties of both plants and animals are still frequently as much influenced by popular fancy or caprice as by the actual economic or environmental factors. In the case of varieties of sugar cane, size and appearance, yes, even a characteristic color or mode of growth may exert more influence than their actual productivity or resistance to disease and it appears to the author that we could find no better illustration of this fact than the case of D-433, the well-known Ce-niza cane, which has proven so valuable under the peculiar conditions of Central Fajardo, in Porto Rico. Careful experimentation and years of experience at this progressive central have demonstrated beyond the shadow of a doubt the value of this cane—normally a variety of good tonnage but indifferent sugar content—under the conditions of most of their properties, but this demonstration under limited conditions does not justify the wide distribution of the D-433 under materially distinct environment of soil and climate. No one will deny, we think, that the good size and ease of identification of this variety, as well as the notoriety it has received from its good record at Fajardo, have been more potent factors in its wide distribution on the Island than results of carefully conducted field trials under the actual conditions of the many other sections into which it has of late years been extended.

With this case in mind, it has occurred to the writer, who has had some fifteen years of experience with a number of the P. O. J. seedlings from Java, which have for the time being at least, settled the disease problems of the Argentine sugar district, from where several of them were sent to Porto Rico, that some similar factors

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might have influenced the rather wide distribution of the so-called Egyptian cane, P. O. J. 105 in the sections of the Island most heavily punished by Mosaic Disease, in comparison with others of its sister varieties which in Argentine gave us far better results than the rather striking-looking P. O. J. 105, and, at the suggestion of Commissioner of Agriculture Mr. Carlos E. Chardón, an investigation of the comparative behavior of these P. O. J. canes in the two countries was begun early this year. The writer has gone rather greatly into detail in considering the Tucumán experiments but feels that a full description of methods and detailed discussion of results in these early experiments are pertinent to the matter in hand, and, given the epoch-making results from these experiments, which, by bringing about a complete change in the basal variety of a whole district, are perhaps unique in Experiment Station history, worthy of rather extended attention.

**Climatic Conditions of Tucumán**

The province of Tucumán—the smallest and most thickly settled of the Argentine States—lies between the 25th and 26th parallels of south latitude, the cane-growing sections being located at elevations of between three hundred and five hundred metres above sea level. The climate is distinctly subtropical, with all of the changes and surprises that that word implies. The summers are extremely warm, temperatures of above 48 degrees Centigrade in the shade having been recorded, and usually extremely rainy, although there are occasional droughts during the summer season (186).\(^1\) The usual rainfall is just about one meter annually, which in normal times falls mostly during December, January and February, more than 50 per cent of the annual precipitation occurring in these three months. This is an ideal distribution of a deficient rainfall for cane growing, coming as it does at the time of greatest heat and hence being taken advantage of during exactly the principal time of the development of the cane. The winters are generally cool and rainless—in most years rivalling the famous Mediterranean coast resorts in their brightness and balminess—with a continuous succession of fresh, sunshiny days and nights just cool enough to stimulate rapid ripening of the cane. At times heavy frosts fall, which, depending upon the time of their arrival, do considerable harm to the sugar content and purity of the juices of the cane and also affect

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\(^1\) Numbers in parenthesis refer to references in annotated bibliography (Appendix C).
the stand for the following year. This is particularly so if the frosts happen to come in late fall or very early winter and follow upon warm, growing weather.

**History of the First Tucumán Experiments**

The Tucumán Sugar Experiment Station was established in 1907 by a more than usually progressive government in order to study the causes of the constantly falling-off yields of cane in the province (182). At the time the law was passed it had been evident for several years that the cane was suffering either from some distinct disease or from a general degeneration such as had already occurred in several countries where the same type of cane (*Rayada*) as formed the basis of the Tucumán cane fields had before been generally cultivated. This trouble later proved to be the same now famous Mosaic Disease which was destined within a few years to cause so much consternation and loss here in Porto Rico—and at the same time to give such a decided stimulus to varietal investigations on the Island.

The work of the new Experiment Station, due to the necessity of finding personnel for work under the peculiar conditions of Tucumán—conditions most closely approximated by those of Louisiana—and of obtaining proper apparatus and securing sufficient preliminary data with which to begin serious investigational work, was begun only in 1910. By this time the Mosaic infection was practically 100 per cent all over the Province and it was clearly seen that the most hopeful line of investigation was along that of varietal resistance or immunity, as control measures of any other sort, given the extremely heavy infection, were practically impossible.

In 1910 one hundred and twenty-six varieties of cane were imported for trial under Tucumán conditions directly from the Louisiana Experiment Station at Audubon Park in New Orleans, these canes representing varieties from almost all the well-known cane countries which were then being experimented with in Louisiana, amongst them being various of the better-known Barbados, Demerara and Louisiana seedlings, *Bourbon, Caledonia Queen, Cavendish, Collyns' Seedling, Lahaina, Rose Bamboo, Salangore, Tamarín* and *Zwinga* (17). In the same year seventy-six additional varieties were obtained from the Campinas Experiment Station in Brazil and each succeeding year promising canes were imported from other countries, amongst these latter being the Hawaiian
FIG. 1.—One of the two varieties of cane which saved the Argentine Sugar industry.
P. O. J. 36 in the Tucuman Agricultural Experiment Station
seedlings Nos. 37, 146, 227 and 240 (76). Hence it will be seen that the Java varieties which we are now going to discuss had to compete with canes of well-established merit and not only with the basic canes of the Province.

Six of the P. O. J. series of Java seedlings were imported into Tucumán direct from Java in the year 1908, as a result of the law creating the Experiment Station, by then Governor Luis F. Nougues, one of the most progressive and far-seeing officials that Tucumán has ever had, and it is a noteworthy fact that three of these canes—the P. O. J. 36, 213 and 234—so far surpassed all other varieties in agricultural and factory yields under every condition of the Province that within a few years they entirely replaced the commonly planted Rayada and Morada, and practically all other varieties which had been tried up to that time (194).

While in cultural experiments or in the control of insects or plant diseases the cooperation of the cane growers and, hence, the rapid obtainment of large-scale results is not very easily secured, there is probably no branch of the very diversified work of an Experiment Station in which the public in general takes so keen an interest as that treating of the introduction or breeding of new varieties of plants. Such huge benefits may be obtained in any district through the finding or creation of a new variety of plant which gives notably better results than the varieties actually cultivated in that section and the expense of obtaining this benefit is usually so much less than that incurred in judicious fertilization or for control measures against insects or plant diseases, etc., that the agriculturist follows with much interest any efforts made towards the end of securing him a better variety which will give him larger returns than those he is actually cultivating. This is probably particularly the case in sugar districts, more especially in one like Tucumán, where it was evident when these experiments were started that the variety under cultivation generally at the time was gradually having its yields reduced to absolutely bankrupt figures (184). This fact must be borne in mind in considering the very rapid change of varieties which has come about as the result of the experiments with these new canes.

What points of superiority, then, had we to seek in judging the new canes in comparison with the old standard ones? Leaving aside the question of frost resistance, which is of no interest to us here in Porto Rico, they were four, as follows:
1st. Greater tonnage, with
2nd. Juices containing a higher percentage of crystallizable sugar.
3rd. Greater resistance or immunity to the attacks of Mosaic Disease and other cryptogamic diseases and insects.
4th. The furnishing of more and better fuel as bagasse.

Too much time would be occupied were an attempt here made to discuss the various complicated features of our extremely careful system of control of our variety experiments. Suffice it to say that the only variant introduced into these experiments was that of the variety and that differences in agricultural or industrial yield at the time of crop may safely be attributed to differences in characteristics of the varieties themselves. Besides having the varieties on plats as nearly apparently equal throughout their extensions as possible and seeing that every detail of preparation, cultivation, fertilization and harvesting was absolutely identical for all varieties, every individual cane was not only weighed out counted it at crop time and the method of obtaining a truly representative sample of each variety for analysis, while too detailed for explanation here, absolutely guaranteed a very true sample.

The experiments were started in 1910, the land selected for the varietal plat under discussion being well plowed with a 26-inch disc plow and harrowed with an ordinary tooth harrow. Rows were indicated with a wooden plow at two metres, then cleaned and deepened with a large double mouldboard plow, the cane being planted in continuous double row the latter part of July, 1910. Three irrigations were given, one each in July, August and September. Fertilizer was applied at the rate of 535 pounds per acre of a mixture consisting of 50 per cent dried blood, 40 per cent superphosphate and 10 per cent of potash. In September the middles were cultivated with a large four-shovel cultivator with the shovels reversed so as to throw the dirt to the middles and the rows were then weeded with spades. In November the middles were cultivated with a light tooth cultivator drawn by one mule and in December a second weeding was given to the rows. Early in January the small cultivator was again sent through the middles, followed, on account of the extremely weedy condition due to recent rains, by a small mouldboard plow. The middle of January the cane was again weeded and early the following month the large cultivator was again sent through, this time with the shovels set to throw dirt to the
rows, the cane being then laid by with spades. Early in March the last cultivation was given with the large middle cultivator, three additional irrigations being then given up to the middle of April 1911. The harvest was made the middle of July, with the results shown in Table I.

Now, as to the first-year stubble—in the middle of September, 1911, the middles were burst out with an ordinary mouldboard plow and the cane off-barred with the same implement with a knife coulter attached. Only one irrigation could be given the first-year ratoons on account of shortage of water, this being at the end of September. Fertilizer was applied as with the plant cane, a little dirt being thrown to the cane when the fertilizer was lightly covered with a small share plow. Early in December the cane was cultivated with the large four-shovel middle cultivator and the six-disc straddling sugar cultivator. About the end of January, 1912, the small tooth cultivator was sent through each middle twice, this completing the cultivation. From this it will be seen that extremely little money was spent on cultivating the stubble cane, no spade or plow work being done after returning the first dirt. The harvest was made early in June, with the results shown in Table I.

As second-, third- and fourth-year stubble, about the same methods were employed as described for the first-year stubble. In September each year the middles were broken out and rows off-barred as already described, this work being followed with one or two irrigations in October, which is usually a very dry month. The second-year stubble was fertilized the first part of November with the same mixture mentioned above, the fertilizer being dropped by hand along each side of the row and lightly covered with a small mouldboard plow. No fertilizer was given the third- and fourth-year stubble or thereafter through ratoons. The latter part of November the large four-shovel cultivator was sent down each middle of the second- and third-year ratoons, while for the fourth-year stubble a Planet Jr. eight-tooth cultivator was employed with good results. In December the rows were given one weeding with spades as second- and fourth-year stubble, but as third-year stubble the Java canes had such a remarkable stand that they were not weeded, only the Rayada being thus weeded. This was in 1913 when no frost fell in Tucumán and, therefore, all cane could make its best development. For the lay-by the large straddling six-disc sugar cultivator
FIG. 2.—The so-called "Egyptian" cane, P. O. J. 105, in Tucuman Station.

"..."
was always employed, the time at which it could be done depending on how early a start the stubble got after crop, the amount of spring rainfall, etc. As second stubble the cane was laid by very early in January, 1913, whereas the third-year stubble got its final lay-by the first part of December of the same year. As fourth-year stubble in 1915 the lay-by was completed the last of December. Usually in January a small tooth cultivator drawn by one mule was sent down the middle, and the second stubble was given an irrigation in January 1913. As third and fourth ratoons the Rayada cane, on account of its poorer stooling, was given a weeding in March, but no later weedicings were given to the Java canes. Crop in each case was made either in July or August, all results being shown in Table I, which we will now study in detail.

### Table I

Results from Five Successive Crops from First Planting of Java P. O. J. Canes, Tucumán Agricultural Experiment Station

**Analyses and Yields of Plant Cane (1911) and Four Successive Stubble Crops (1913-1915)**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Metric tons cane per hect.</th>
<th>Average weight stalks tons.</th>
<th>Chemical analyses of juices</th>
<th>Kgs. of...</th>
<th>recoverable per...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Brix</td>
<td>Sucrose</td>
<td>Glucose</td>
</tr>
<tr>
<td>P. O. J. 36</td>
<td>52.20</td>
<td>500</td>
<td>17.9</td>
<td>11.5</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>76.14</td>
<td>700</td>
<td>17.0</td>
<td>16.6</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>83.10</td>
<td>800</td>
<td>19.3</td>
<td>16.3</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>73.63</td>
<td>700</td>
<td>80.0</td>
<td>17.5</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>65.60</td>
<td>600</td>
<td>11.3</td>
<td>11.5</td>
<td>0.9</td>
</tr>
<tr>
<td>Average...</td>
<td>66.60</td>
<td>810</td>
<td>17.7</td>
<td>14.7</td>
<td>0.3</td>
</tr>
<tr>
<td>P. O. J. 213</td>
<td>30.55</td>
<td>370</td>
<td>17.4</td>
<td>11.7</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>89.50</td>
<td>970</td>
<td>17.5</td>
<td>13.7</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>108.80</td>
<td>600</td>
<td>19.0</td>
<td>12.7</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>54.00</td>
<td>500</td>
<td>80.0</td>
<td>14.8</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>60.99</td>
<td>470</td>
<td>17.0</td>
<td>14.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Average...</td>
<td>73.27</td>
<td>580</td>
<td>17.7</td>
<td>14.9</td>
<td>0.2</td>
</tr>
<tr>
<td>P. O. J. 281</td>
<td>28.65</td>
<td>450</td>
<td>19.5</td>
<td>18.8</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>69.50</td>
<td>750</td>
<td>18.1</td>
<td>15.5</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>66.29</td>
<td>720</td>
<td>19.7</td>
<td>17.2</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>44.66</td>
<td>720</td>
<td>21.0</td>
<td>18.2</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>41.86</td>
<td>590</td>
<td>15.5</td>
<td>12.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Average...</td>
<td>50.21</td>
<td>640</td>
<td>18.9</td>
<td>16.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Rayada</td>
<td>22.73</td>
<td>480</td>
<td>18.1</td>
<td>13.8</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>27.34</td>
<td>700</td>
<td>18.0</td>
<td>13.8</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>24.46</td>
<td>800</td>
<td>17.2</td>
<td>15.2</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td>17.40</td>
<td>650</td>
<td>20.4</td>
<td>18.4</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>11.90</td>
<td>550</td>
<td>15.2</td>
<td>12.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Average...</td>
<td>22.15</td>
<td>630</td>
<td>17.0</td>
<td>14.8</td>
<td>0.3</td>
</tr>
<tr>
<td>P. O. J. average...</td>
<td>63.36</td>
<td>677</td>
<td>18.1</td>
<td>15.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>

a Obtained by multiplying per cent sucrose by purity—usual factor in Tucumán.

** Calculated from a basis of 70 per cent extraction of juice on cane.
Taking up first the results from the plant cane, we find that the largest production of sugar per hectare was made by the P. O. J. 234, all the analyses, however, being very good for cane cut so early, July in Argentine, of course, corresponding to January here in Porto Rico. All three of the Java varieties gave sugar contents superior to that of the Rayada. In tonnage of cane produced the P. O. J. 36 headed the list, having also the best average weight of stalk. The Java canes produced an average of over one ton more sugar per hectare than did the Rayada check plat.

The first thing that strikes us about the results of the first ratoons is the tremendous increase of the yields of the Java varieties over their production of the previous year, both in tonnage and in average weight of stalk. It was this particular comparative increase that made us consider these Java canes so promising and caused us to immediately start large sub-station experiments in all parts of the Province, because in the second year they already appeared to be adapting themselves well to their new environment and conditions of growth, especially when we consider that in their native home cane is grown only as plant. Incidentally, the large substations started in 1912 corroborated the results obtained at the central Station in every respect and were an important factor in diffusing knowledge in regard to these canes and in multiplying the supply of seed then existent (10).

As first stubble the P. O. J. 213 stands head and shoulders above all the rest, with over ninety tons of cane per hectare and 7½ tons of sugar and his in comparison with very good yields from the Rayada, as Tucumán averages for their native canes went, of over 27 tons of cane and 2½ tons of sugar per hectare, against a normal average for the Province of about twenty tons of cane and 1¾ ton of sugar. All of the Java canes more than doubled their yields as plant, the P. O. J. 213 more than trebling that on previous year, while the Rayada increased its yield of cane but 5½ tons and its sugar about three-fifths of a ton per hectare.

As regards the chemical analyses of the juices, the P. O. J. 234 again leads all the rest, as it did as plant cane. The average production of cane and sugar per hectare of the Java varieties is some 150 per cent higher than the very respectable Rayada yield, the average weight of stalk also, contrary to public opinion, due to the thinness of these canes, being slightly superior—that of the P. O. J. 36 very much higher.
As regards the results of the last three years of stubble, attention should be called to the fact that the years 1913 and 1914 were the two most favorable years ever known for cane growing in the Province of Tucumán, there being abundant rainfall in these years and practically no frost anywhere in the Province. 1915, on the other hand, was a disastrously dry and cold year, breaking all previous records for low yields until 1916 and 1917 each in their turn established new high-frost and low-yield marks.

Table I hardly needs extended discussion, as it very volubly speaks for itself. We need call attention only to the enormous differences in the average yields for five years of the Java and native cane, the latter showing an increase of from 140 to 220 per cent in yield of sugar per hectare under identical conditions of growth and under less expense for cultivation than the Rayada. It is also worth noting that the P. O. J. 231, while the lowest in tonnage of the Java canes, has given the highest average sucrose content and proven itself a very early maturing variety.

THE SECOND SERIES OF TUCUMÁN EXPERIMENTS

After obtaining three years’ splendid results with these new canes, in sub-stations distributed all over the Province as well as those detailed above in the main Station, we decided to start a special lot of larger scale experiments with these more promising varieties. A piece of land, which had carried alfalfa for two years and was, therefore, in the best of condition for receiving cane, was selected for the experiment. The land was well prepared in July, 1913, and planted in rows 1.66 meters apart instead of at two meters as in the first experiment, the cane being covered with a small mouldboard plow as before. The system of cultivation was practically the same as outlined for the first series of experiments, this latter one being run for three years (one plant crop and two ratoons) or until the check plats, as in the case of the other experiment, had been reduced to such irrisory figures that comparison would no longer have been possible. Incidentally it might be mentioned that the P. O. J. canes in this first series of varieties were left to grow and furnish data on their duration as ratoons, of which anon, for as many years as possible after these comparative figures were discontinued on account of the lack of a check and the P. O. J. 36 and 213 have continued to give splendid yields
FIG. 3.—Another Argentine benefactor, P. O. J. 213 at Experiment Station
through the twelfth year stubble. The thirteenth stubble crop has
grown splendidly and will be harvested shortly.

As will be seen from Table III, when the second series of experi-
ments was discontinued the P. O. J. canes were still giving very sub-
stantial stubble yields and these have continued to date also. No
comparative results can be calculated, however, where the check
plants have become so depreciated in their yields.

In this second series of experiments an interesting study was
made of the germinative potency of the different canes, one of the
factors which well explains the success obtained from the Java canes
in the Argentine. Beginning about the middle of September, 1913,
a count was made each week of the number of sprouts above ground
in one row of 100 meters in length of each variety until suckering
began in abundance. Table II gives the results of these investi-
gations.

**Table II**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Number of sprouts above ground per row of 100 metres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>September</td>
</tr>
<tr>
<td>P. O. J. 36</td>
<td>1</td>
</tr>
<tr>
<td>P. O. J. 234</td>
<td>100</td>
</tr>
<tr>
<td>Rayada</td>
<td>60</td>
</tr>
<tr>
<td>P. O. J. average</td>
<td>90</td>
</tr>
</tbody>
</table>

Nothing could illustrate better than this table the strong ger-
minative tendencies of the Java canes as compared with the native.
Both in experimental tests and in field observations we have always
noted that the P. O. J. 234, in common with most high-sugar
content and early maturing canes—B 208, for instance—is a very
quick germinator, whereas the P. O. J. 213, particularly in dry
seasons, germinates very tardily and seems to make its best growth
from the time of coming of the real summer months. Both of
these tendencies are very well shown by the table. On September
18th the P. O. J. 234 had three times as many sprouts per row as its
closest rival—the Rayada—and on the 9th of October still had twice
as many sprouts as the P. O. J. 213, but, nevertheless, at crop time
the P. O. J. 213, which had suckered vigorously after November,
had matured more stalks per row than the P. O. J. 234—stalks, by
the way, with greater average weight by 190 grams. Another in-
teresting comparison is that between the P. O. J. 213 and 36, the
latter variety which we have always found to be a quicker germi-
nator than the former. On the 18th of September the P. O. J. 36
had just exactly half the number of sprouts per row as the P. O. J.
213; nevertheless, just one week later the P. O. J. 36 had 51 sprouts
more than the P. O. J. 213 and at the time of the last count on the
6th of November, the P. O. J. 36 had almost 200 sprouts per 100
meter row more than the P. O. J. 213.

Another interesting point which this table brings out is that
when we talk of twelve- or fourteen- or sixteen-month cane, we are
not describing by any means exactly the average age of the canes
we are sending to the mills. Of the P. O. J. 213 cut at the harvest
of these plant canes on the 1st of September, 63 per cent had started
growth after the first week in November and, hence, had a maximum
growth of but ten months. Over half of the stalks of the P. O. J. 36
germinated after the first week of November, about one-third of the
P. O. J. 234 and almost half of the Rayada. An interesting field of
research along this line remains open in studies of our varieties—
some attempt to define exactly what the terms "fifteen-month" or
"eighteen-month" cane mean, give some idea of how old the average
cane really is at these different ages with the distinct varieties.

An examination of the results of three crops from this plan-
tation, i. e., the plant cane of 1914 and the first and second ratoons
of 1915 and 1916, respectively, the latter two disastrously unfavor-
able crops for all Tucumán cane, shows us (Table III) that in this
series of experiments the comparative results of the Java varieties
and the native cane are even more striking than in the former
series. So evident is this superiority that comment on the table is
is unnecessary, hence we can turn our attention for a moment to
Table IV, giving the average results for the eight crops from the
plantings.
SOME JAVA P. O. J. SEEDLINGS IN TUCUMAN AND PORTO RICO

### TABLE III

Results from Three Successive Crops from Second Planting of Java P. O. J. Canes, Tucumán (Argentina) Agricultural Experiment Station

[Top lines represent plant cane (1914), middle lines first stubble and bottom lines second-stubble (1916)]

<table>
<thead>
<tr>
<th>Variety</th>
<th>Metric tons cane per hect.</th>
<th>Average weight per stalk (Gms.)</th>
<th>Chemical analyses of juices</th>
<th>Kgs. of sugar recoverable per hect.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Brix</td>
<td>Sucrose</td>
</tr>
<tr>
<td>P. O. J. 36</td>
<td>57.72</td>
<td>1010</td>
<td>17.3</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>101.58</td>
<td>690</td>
<td>15.1</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>36.15</td>
<td>700</td>
<td>17.1</td>
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<td>11.5</td>
<td>11.1</td>
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<td>61.88</td>
<td>480</td>
<td>14.7</td>
<td>11.9</td>
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<td>573</td>
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<td>42.80</td>
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<td>12.0</td>
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<td>41.57</td>
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<td>12.5</td>
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<td>42.68</td>
<td>537</td>
<td>16.1</td>
<td>12.8</td>
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<td>537</td>
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<td>65.49</td>
<td>650</td>
<td>16.3</td>
<td>12.7</td>
</tr>
</tbody>
</table>

### TABLE IV

Average of Results of Eight Crops from Two Plantings

| P. O. J. 36 | 76.05 | 810 | 17.4 | 11.2 | 0.5 | 81.6 | 11.6 | 6175 |
| P. O. J. 213| 68.88 | 690 | 17.0 | 12.9 | 0.5 | 81.8 | 11.4 | 5497 |
| P. O. J. 231| 47.63 | 650 | 17.5 | 14.5 | 0.7 | 85.7 | 12.5 | 4159 |
| Rayada       | 22.49 | 610 | 16.1 | 13.2 | 0.6 | 83.4 | 11.2 | 1764 |
| P. O. J. average... | 61.15 | 678 | 17.4 | 14.9 | 0.4 | 82.4 | 11.8 | 5277 |

*All averages in these tables are obtained by adding together the figures for the various years and dividing by the number of years represented, instead of calculating values from the average figures, as for instance, average purity from av. brix divided into av. sucrose.*

We find that the P. O. J. 36 heads the list of varieties, with the splendid average yield for Tucumán of more than 75 tons of cane and 6 tons of sugar per hectare, in comparison with 22½ tons of sugar for the native—a yield, be it remembered, above the average for the Rayada in Tucumán in good years. The average chemical analysis of the P. O. J. 36, results better than the native. The yield and analysis of the P. O. J. 213 is very close to that of the P. O. J.
FIG. 4.—The sweetest of the P. O. J. cane—251—in one of the variety plots of the Tucumcari Experiment Station.
36 and still more than three times the native yield. The juice of the
P. O. J. 234 has maintained its position throughout the test as the
richest of all of the varieties and in yield of both cane and sugar
per hectare it has exceeded the native Rayada by well over 100
per cent.

DEFINITIVE RECOMMENDATION AND EXTENSION OF THE P. O. J. CANES

After such a long series of experiments and demonstrations in
all parts of the Province, during which the most promising varieties
had been multiplied in strategic locations so that large-scale planting
was immediately practicable, no further doubt could exist as to
the superiority of these three P. O. J. canes over the native Ra-
yada and the other canes tried under Tucumán conditions (69). At
the Experimental Station and in the sub-stations, some of which
were very large observation fields, we had by 1916 six full years
of experience with the new canes under every climatic condition
conceivable for Tucumán. The results showed an average yield in
cane and sugar per hectare of the three P. O. J. canes we have been
considering of just about three times that of the Rayada yields dur-
ing the same period and under identical conditions throughout and
these results had been confirmed by the large planting of several of
the more progressive and wide-awake centrals. The time had come,
therefore, for the Experiment Station to make definite recommend-
dations of these canes for supplanting the native striped and purple
ones. Early in 1915 an active propaganda was commenced and was
duly continued for several years until the planter, large and small,
had been induced to leave off the expensive cultivation of the sorely
weakened native canes and supplant them as rapidly as possible with
the vigorous, rapid-growing Java ones, following the counsels of the
Experiment Station officials as to the best of the Java varieties for
their particular conditions of abundance or lack of irrigation water,
type of soil, etc., etc. With the crop of 1915 practically a complete
failure, then—in that year the Province produced less than half of
the 233,000 tons of sugar turned out the previous year—the more
progressive planters of Tucumán at last put their prejudices and
sentiments into their pockets and began to plant the new canes
most vigorously, many of them paying enormous prices for seed
cane to the still more progressive men who already had large
plantings of these varieties established. Some of these latter men
made fortunes through their longheadedness. When in 1916 the
FIG. 5.—A stool of P. O. J. 36 in Tucumán Experiment Station
average yield of native cane dropped to only about eight tons per
hectare, the prejudices against these foreign invaders of their cane
fields almost entirely disappeared and some fifty thousand acres of
these canes were laid down, the P. O. J. 213, as an all-round
cane, predominating. The comparatively good development of these
plantings in the unprecedentedly unfavorable season of 1916–17,
when the native canes, due first to frost and then to drought, prac-
tically did not make any growth at all, was the straw that broke
the proverbial camel’s back and in 1917 everybody fell over them-
selves to secure seed of the Java varieties, paying almost any price
asked by the more fortunate possessors of P. O. J. canes, prices of
twice the ordinary factory price being paid for seed in train-load
quantities with the greatest cheerfulness. It is probable that an-
other sixty thousand acres were planted in 1917, which figure was
very little added to in 1918, due to the frosts being so early and so
heavy that extremely little good seed was available (105). In 1919
and 1920 the substitution of the Java canes, principally P. O. J. 36
and 213, the P. O. J. 234 being used only for early grinding, since
it does not compare with the other two varieties in field tonnage,
went merrily on, the last official statistics in 1923 putting the
amount of native cane remaining in the Province at 864 acres against
203,162 acres of the Java canes—a replacement of about 991/2 per
cent. Indeed, today the native canes, as the writer predicted in an
address in Buenos Aires six years ago (182), are looked on as
curiosities when an occasional specimen reaches the mills, practically
always mixed in with ears of P. O. J. canes. Such is the bloodless
revolution which has taken place in the “Garden of the Argentine
Republic” in the comparatively small space of time of less than one
decade.

An idea of the magnitude of the reconstruction on some of the
centals which had given no attention to the Java varieties before
the disastrous crop of 1915 may be gained from the writer’s ex-
perience at the Santa Ana estates, the largest in the Province and
probably in South America, to take charge of which he resigned the
directorship of the Tucumán Experiment Station during the crop
of 1916 (27). For that crop the Ingenio Santa Ana had some
fifteen thousand acres of cane, not one stalk of which was of the
Java varieties. In the following two years we entirely renovated
these huge plantations with the Java varieties, and for the crop of
1918 there was not a single stalk of native cane on the entire place.
Incidentally, some of the results obtained from these plantings may be pertinent to this discussion and will be found in Table V. The results from these thirty-five fields represent cane harvested from some one thousand acres during the crop of 1919, a year of serious early frosts, and, hence, of low sugar contents and purities in general, as will be noted in Table V. All fields were ratoons (192.)

### Table V

**Detailed Results of Stubble of Java Canes from 1,000 Acres**

*Ingenio Santa Ana, Tucumán Province*

<table>
<thead>
<tr>
<th>Field</th>
<th>Stubble per hect.</th>
<th>Brix</th>
<th>Sucrose</th>
<th>Purity</th>
<th>Manfg. value</th>
<th>Ks. sugar per hect.</th>
</tr>
</thead>
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</tbody>
</table>

Average 38.21

### Table II

**P. O. J. 213**

<table>
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<tr>
<th>Field</th>
<th>Stubble per hect.</th>
<th>Brix</th>
<th>Sucrose</th>
<th>Purity</th>
<th>Manfg. value</th>
<th>Ks. sugar per hect.</th>
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</table>

Average 51.70

These results may be taken as fairly accurately representing the comparative value of the *P. O. J. 36* and 213 all over the Argentine sugar district today, the *P. O. J. 36*, on account of its larger
FIG. 6.—P. O. J. 213 on new land at Ingenio Santa Ana, Argentina.
This cane is just five months old from planting
diameter and easier stripping, as well as its erectness, having gradually come to occupy first place in the preferences of the planters, although a much larger proportional area of the *P. O. J. 213* was at first laid down, while the *P. O. J. 234*, though an early maturer, is now generally recognized as being a much more delicate cane in every sense than its sister varieties and, hence, over a long series of years, giving a much lighter average yield. *P. O. J. 234*, however, does have the advantage of being a very quick germinater and an erect, rapid grower and, although it has the decided defect of forming numerous adventitious roots, it does not have the drawback of lodging so characteristic of the *P. O. J. 213*, though not of the *P. O. J. 36*. This tendency to lay over, particularly after heavy rains, is one of the few serious points which can be advanced against the *P. O. J. 213*. The *P. O. J. 36* is also rather a quickly germinating variety, but in average richness of juice it is probably slightly inferior to the *P. O. J. 213*, although under normally favorable conditions it can generally be counted upon to offset this condition by giving around a ten per cent better agricultural yield.

Under distinctly unfavorable conditions of any sort, however, neither of the other two varieties mentioned can compare with the *P. O. J. 213* as an all-round cane and for this reason the Argentine planters will do well to always maintain at least half of their plantations in this variety. Under severe drought conditions it is a very slow germinater, but even under the most extreme of such conditions it will not dry out and perish entirely as the *P. O. J. 36* or *234* and with the first rains is up and away as few other canes that the writer has observed.

As regards distinctly unfavorable conditions, the writer has had one experience with hail that he is not likely to forget and which illustrates nicely the extreme resistance of the *P. O. J. 213* to the most unfavorable of conditions. On the 17th of December, 1919, about one-third of the plantations of the Santa Ana estate, which were then almost ready for the lay-by, were swept away by a hailstorm such as the author hopes never again to have the misfortune to witness. The hail lasted exactly twenty-two and a half minutes in the center of the storm and was accompanied by a sixty-mile wind—a veritable tornado—the enormous hail stones coming along almost horizontally and with such force as to leave all brick and concrete walls and even quebracho fence posts with southern exposure as pitted as if they had been fired into with machine guns.
After the piled-up hailstones melted, which was not for six or seven hours in the open fields, although the maximum temperature that day was 105 degrees Fahrenheit in the shade, not a cane stool could be seen standing erect, and two or three days afterwards the entire belt which had been scourged by the hail looked exactly as though a prairie fire had swept over it, leaving not a vestige of green in its wake. Nevertheless, with only four months' growth, the P. O. J. 213 in this zone re-erected itself as if nothing had happened and in the crop of 1920 gave us an average yield of about fifteen tons of cane per hectare, whereas the P. O. J. 36 did not produce fifty per cent of that quantity. Incidentally, we might state that the stubble of the P. O. J. 213 recovered perfectly and gave splendid yields again in the next and following crops, while that of the P. O. J. 36 needed a great deal of replanting to restore it to anything like its original productiveness. Of course this is a very extreme case which is not likely soon, if ever, to be repeated, but all of these points should be carefully borne in mind by the planter who is selecting the basis for his future plantations.

In the Argentine the writer advised the use of the P. O. J. 213 for very early and very late harvesting and the P. O. J. 36 in the middle months.

**Duration of the P. O. J. Canes as Ratoons**

In our opening remarks in regard to the second series of Tucumán experiments, we mentioned the fact that the stronger ratooning canes, such as the P. O. J. seedlings and the Uba, which were planted in 1910 in the first experiment which we have discussed with these canes, were left growing after the original experiment had to be discontinued on account of the check plots having practically run out, in order to obtain some data as to the probable duration of stubble crops from these stronger varieties. The results of thirteen successive harvests from this original planting—one of plant and twelve of stubble—have recently been published (81) and the data furnish material for an interesting study of the remarkable "sticking power" of the P. O. J. 36 and 213 under Tucumán conditions—this, be it noted, despite the very large number and intensity of the frosts which have fallen in the province during this long period and despite a 100 per cent Mosaic infection from the planting of the original seed. It should be noted, also, that these results are made all the more striking by the fact that the original planting
FIG. 7.—First ratoons of the P. O. J. 213 at five months. Ingenio Santa Ana.
has never been replanted even to the extent of filling in a single lost stool, nor has this plat received any special cultivation or fertilization—in fact the amount of both have been almost an irreducible minimum. In view of these facts we are inclined to think that the records from this experiment are decidedly unique and that there is little data anywhere covering the yields and manufacturing value of so many successive crops from one original plantation and without any replanting. The writer has run across canefields in various parts of the word whose proud owners claimed that they were fifteen, twenty or even twenty-five years old, but investigation generally revealed the fact that more or less extensive replanting had been done each year or two and it is highly probable that little of the original plantation remained. Most of these cases, in our opinion, are comparable to the case of the man who dilates on the fact that he has had his Ford car for ten years and that it is still "as good as new". It probably is as perfect as the original purchase, but it is also probable that, with the many repairs and replacements, very little of the original car remains besides the radiator cap or the switch key!

In order to avoid a redundancy of data, which has already grown rather voluminous, we give in Table VI only the results of the tenth, eleventh and twelfth stubble crops, made at the end of August 1921 and 1922 and early in July in 1923.

### Table VI

Results from Tenth, Eleventh and Twelfth Stubble Crops from Original Plantings of Java P. O. J. Canes, Tucumán Agricultural Experiment Station

<table>
<thead>
<tr>
<th>Crops of 1921, 1922 and 1923</th>
<th>Variety</th>
<th>Tons cane per hectare</th>
<th>Average weight per stalk (grams)</th>
<th>Chemical analyses of juice</th>
<th>Recoverable sucrose per hect. ks.</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Brix</td>
<td>Sucrose</td>
</tr>
<tr>
<td></td>
<td>P. O. J. 36</td>
<td>58.50</td>
<td>520</td>
<td>17.39</td>
<td>15.13</td>
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<td>P. O. J. 213</td>
<td>57.25</td>
<td>580</td>
<td>19.52</td>
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<td></td>
<td>Average</td>
<td>56.92</td>
<td>557</td>
<td>18.38</td>
<td>16.39</td>
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<td>P. O. J. 234</td>
<td>82.00</td>
<td>470</td>
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<td>55.00</td>
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<td>20.46</td>
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<td></td>
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<tr>
<td></td>
<td>Average</td>
<td>24.67</td>
<td>433</td>
<td>18.86</td>
<td>16.30</td>
</tr>
</tbody>
</table>
### Table VII

Results from Third, Fourth and Fifth Stubble Crops from Native Striped and Purple Cane Well Cultivated, Tucumán Agricultural Experiment Station

**Crops of 1921, 1922 and 1923**

<table>
<thead>
<tr>
<th>Manured</th>
<th>Tons per hectare</th>
<th>Average weight per stalk (grams)</th>
<th>Chemical analyses of juice</th>
<th>Recoverable sucrose per hect. ks.</th>
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<td>17.45</td>
<td>13.08</td>
</tr>
<tr>
<td></td>
<td>18.10</td>
<td>433</td>
<td>16.64</td>
<td>11.19</td>
</tr>
</tbody>
</table>

A glance at Table VI and a comparison of it with Table I show us that *P. O. J. 36* and 213 have maintained their high standards of production in these very old stubble crops, while the *P. O. J. 234* has dropped very materially in its average yield, in accordance with its earlier record as not such a vigorous cane in any respect as the other two here studied. There will also be noted with all of the three canes a very natural tendency, on account of their remarkable ratooning power, of having a slightly lower average weight of stalk as the ratoons get older. On the other hand the sucrose content and purity of the *P. O. J. 36* and 213 tend to rise directly with the age of the ratoons.

It is difficult to find, therefore, the economical limit of stubble cane for the *P. O. J. 36* and 213 in Tucumán. Undoubtedly it is a poor agricultural practice to leave one crop on the same land for so long a period, but we think it is hardly probable that the average planter would be content to plow out this stubble, even at the age of fifteen years while it continues to give him such substantial and profitable yields with a minimum expense of cultivation, the *P. O. J. 36* and 213 as stubble closing so rapidly that very little cultivation is possible. On the whole, we gather from Table VI that the average results from the last three stubble crops of these canes are slightly better in yield of both cane and sugar per hectare in the case of the *P. O. J. 213* than in that of the *P. O. J. 36*, although the former is susceptible to much wider fluctuations in yield in distinct years than the *P. O. J. 36*.

On the same page with Table VI are given for comparison in
Table VII the results from the third, fourth and fifth stubble crops of native striped and purple cane harvested the same years as the tenth, eleventh, and twelfth ratoon crops of the P. O. J. varieties with the results shown in Table VI. A comparison of the average results in the two tables shows how utterly inferior in every respect are the results from these stubble crops from the native cane to those obtained from the P. O. J. varieties from infinitely older stubble, although the native cane constituted a series of plats used for testing the value of the native cane under optimum conditions.

Cross (85) in 1917 started these experiments with the object of determining if it could be made to give satisfactory yields by employing the best of cultivation methods, heavy fertilization with stable manure, etc., and the giving of the longest possible growing season by late harvesting in years of little frost. As stubble alternate plats were fertilized each year with an application of stable manure at the rate of thirteen tons per hectare. As will be seen from Table VII, the effect of the manure was nil, since the unmanured cane gave slightly more cane and sugar per hectare than the manured plats, nor was there any appreciable effect of the manuring on the average weight of the stalks. Of this Cross says:

"This confirms the results obtained by the Experiment Station in similar experiments from 1910 to 1915 (175) which indicated that the native cane, degenerated from the attacks of Mosaic Disease, does not respond to manuring."

VALUE OF THE P. O. J. CANES TO THE ARGENTINE INDUSTRY

We may safely say, then, that several of the P. O. J. canes—36 and 213 in particular—have saved the Argentine sugar industry from absolute bankruptcy, for no industry could resist the enormous losses which would have had to be sustained had Tucumán not had within its reach the salvation from the ridiculous yields to which its native canes had fallen—if she had not found the remedy already waiting for her when ruin was staring her in the face. It is probable that there is not a case in the history of Experiment Stations—and there are some remarkable chapters in that history—where one of the principal industries of an entire section has been so rapidly reconstructed and entirely saved in the short space of seven or eight years.

There is a very common tendency in certain quarters to look upon the work of an experiment station as something extremely and luxuriously theoretical—as interesting, yes, but of slight practi-
cal importance. We think that the work of the Tucumán Experiment Station which we have just been discussing may well be used as evidence in refuting any such charge. Let us see, for example, what this one series of varietal investigations alone may mean in dollars and cents in simply the saving in annual expenditures of the Tucumán planters. And the figures here given are not theoretical ones, but are based on the actual costs from thousands of acres of the two distinct types of cane from the time of planting to that of harvest. It is generally conceded in Tucumán that the native cane, year in and year out, costs for cultivation just about twenty dollars per acre—in fact this was for decades the amount universally advanced by the factories to their colonos and cañeros. The average yield for the native (Rayada) cane, before the last series of disastrous years, was but a little over eight tons per acre. That means, therefore, that the cost of cultivation of the Rayada cane per ton was about $2.25. We have seen that the P. O. J. canes are quicker growing and, hence, need less weeding and general cultivation, while yielding from twice to four times as much as the native cane. Let us take as a conservative figure only twice the yield of the native cane and assume that we will spend 80 per cent as much in cultivation per acre, a figure which should never be realized, as the Java canes are actually cultivated at a much lower rate than this. This means, then, reduced to cost per ton, that the Java cane's cost for cultivation a little under one dollar per ton, whereas the Tucumán planters have been in the habit of spending $2.25 on the native cane. The Tucumán planters, then, are today saving in cost of cultivation at least $1.25 on every ton of cane they deliver to the factories. In her last crop the Province of Tucumán ground slightly over three million tons of cane, which would work out at an annual saving of over three and three quarter millions of dollars in cost of cultivation of the area required to produce this amount of the Rayada cane even were it possible to produce it—and the annual cost of the Experiment Station to the Province has been about 1 per cent of this amount!

The So-Called Egyptian Cane—P. O. J. 105

P. O. J. 105, one of the same series of canes which we have been discussing, all produced by crosses of Cheribón (our Porto Rican Rayada is the Striped Cheribón) and Chunnee by Kobus in Java, was introduced into Egypt many years ago by the Société Générale des Sucreeries d'Égypte, which company holds practically the mo-
nopoly of the Egyptian sugar industry, and is by no means, as has been more or less commonly thought, indigenous to that country.

Under date of 10th of May, 1913, the Société Générale des Sucrieries in a letter to Messrs. Hileret & Co., owners of the "Santa Ana" estates in Tucumán, gave us the following information about this variety:

"It is remarkable for its elevated production and its surprising rusticity, which resists better than any other the fluctuations of climate and irrigation. Foliage abundant, sugar content generally equivalent to that of the 'rabanée du pays', i. e., between 13 and 14½ per cent, but its maturity is generally one or two points lower. Nevertheless it will produce an amount of extractable sugar per hectare superior by 30 to 60 per cent to the other varieties here. We can easily obtain with the P. O. J. 105 a yield of 115 tons of cane per hectare, with 10 to 10.25 per cent white sugar bagged, in spite of the fact that in Egypt we have but an eight-month growing season.

"Its defects are, (1) quick inversion after cutting, which means organization for quick deliveries and grinding, and (2) greater difficulty in stripping than with the other varieties. However, we consider that its advantages considerably outweigh its defects."

About this time this variety was introduced, as "Ambar de Egipto", into the Province of Tucumán by the Nougués Brothers, proprietors of the San Pablo factory and plantations, and the material for trial at the Sugar Experiment Station of Tucumán was obtained from those gentlemen. In the characteristics of this cane we find much in common with the other canes of this series, as it is a tall-growing, thin type of cane of vigorous development and high ratooning qualities. In Tucumán and in Egypt the characteristic stalk color is amber, a color quite common in the younger canes here in Porto Rico, but after the older canes have suffered exposure to the sun they become a rose color somewhat similar to that of P. O. J. 36, although quite a number of stalks are found of a green shade very similar to that of the P. O. J. 331, with both of which canes this variety is sometimes confused. The buds, however, are quite distinct for the three varieties, as may be seen from a study of the illustration of the same in this publication. Generally the stalks are rather heavily coated with wax in the P. O. J. 105.

In the first few years after its introduction the P. O. J. 105 received a great deal of attention from planters in the Province of Tucumán, Nougués Brothers very rapidly extended their acreage—as, incidentally, they had previously done with the P. O. J. 100, only to have to destroy it later on when it was found that it suffered very severely from Mosaic attack—reporting lower fibre
content and higher percentage of sugar for the P. O. J. 105 than for other P. O. J. canes, and requests to the Experiment Station for seed were many and beseeching. The fond hopes founded on this cane, however, were never justified in Argentina, for, while careful experimentation at the Station proved it to have many very excellent qualities, it never made a showing which would permit it to compete very seriously there with either the P. O. J. 36 or 213.

When the writer left the Argentine, Nogués Brothers, in spite of our rather indifferent results with P. O. J. 105 at the Experiment Station, were still multiplying their plantings of this variety, and a number of other factories and planters were following suit in a minor degree. The writer recently wrote to Dr. W. E. Cross, who succeeded him as Director of the Experiment Station and to whom he wishes to express his appreciation of the valuable information furnished him for this paper, requesting data upon the plantings of the P. O. J. 105 at San Pablo and other places where this variety was rather popular several years ago. Dr. Cross was kind enough to send us a letter which he had received in answer to his inquiry from Engineer José Padilla, Manager of Ingenio San Pablo, in which he states that "We have been obliged to replace it with P. O. J. 36 and 213 to such an extent that we now have only about ten hectares of the P. O. J. 105 left on our estates."

We received the P. O. J. 105 at the Tucumán Experiment Station in 1914 and observations on it have been made constantly since that time. It was planted in three distinct lots in 1914, 1916 and 1917, the results of which Cross has recently published. We give below the results of second, third and fourth ratoons, from the crops of 1919, 1920 and 1921, as Table VIII, a comparison of which with Tables I, III and VI will demonstrate that, while this variety has given satisfactory cultural results, it is decidedly inferior to the other P. O. J. canes.

TABLE VIII
P. O. J. 105 in Tucumán

[Second-year stubble on first line (1919), third and fourth year successively]

<table>
<thead>
<tr>
<th>Metric tons cane per hect.</th>
<th>Average weight stalks (Gms.)</th>
<th>Chemical analyses of juices</th>
<th>Kgs. of sugar recoverable per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Brix</td>
<td>Sucrose</td>
</tr>
<tr>
<td>34.65</td>
<td>560</td>
<td>19.31</td>
<td>15.38</td>
</tr>
<tr>
<td>31.60</td>
<td>520</td>
<td>14.98</td>
<td>11.31</td>
</tr>
<tr>
<td>34.15</td>
<td>510</td>
<td>16.36</td>
<td>12.16</td>
</tr>
</tbody>
</table>
Immunerable experiments by Cross (63) failed to prove the much talked-of early maturing qualities of the P. O. J. 105, as compared with the other canes of this series. In 1920 and 1921 most exhaustive tests were made to study this all-important point, analyses of several of the more promising canes being begun each year late in March or early in April (crop in the Argentine commences the latter part of May or early in June) and repeated each week from the same plots. The writer knows of no more complete maturity studies anywhere than those made by Cross in this series of tests. The data is very voluminous, only half of those for the year 1921 being given here, as Table IX.

**Table IX**

Ripening of the P. O. J. Canes in Tucumán

*Alternate Weekly Analyses, made at the Sugar Experiment Station*

<table>
<thead>
<tr>
<th>P. O. J. No.</th>
<th>Brix</th>
<th>Sucrose</th>
<th>Glucose</th>
<th>Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8th of April</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>18.76</td>
<td>10.58</td>
<td>1.24</td>
<td>75.88</td>
</tr>
<tr>
<td>105</td>
<td>13.31</td>
<td>9.32</td>
<td>1.19</td>
<td>71.35</td>
</tr>
<tr>
<td>213</td>
<td>13.31</td>
<td>11.29</td>
<td>0.76</td>
<td>81.38</td>
</tr>
<tr>
<td>234</td>
<td>17.07</td>
<td>14.10</td>
<td>0.57</td>
<td>87.33</td>
</tr>
<tr>
<td></td>
<td>22nd of April</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>15.57</td>
<td>11.94</td>
<td>0.91</td>
<td>77.65</td>
</tr>
<tr>
<td>105</td>
<td>16.57</td>
<td>12.34</td>
<td>0.46</td>
<td>76.65</td>
</tr>
<tr>
<td>213</td>
<td>14.57</td>
<td>11.53</td>
<td>0.72</td>
<td>81.88</td>
</tr>
<tr>
<td>234</td>
<td>18.38</td>
<td>16.11</td>
<td>0.45</td>
<td>87.64</td>
</tr>
<tr>
<td></td>
<td>6th of May</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>15.03</td>
<td>12.88</td>
<td>0.70</td>
<td>89.55</td>
</tr>
<tr>
<td>105</td>
<td>14.33</td>
<td>10.87</td>
<td>0.67</td>
<td>78.32</td>
</tr>
<tr>
<td>213</td>
<td>16.68</td>
<td>14.23</td>
<td>0.67</td>
<td>85.31</td>
</tr>
<tr>
<td>234</td>
<td>18.68</td>
<td>16.22</td>
<td>0.29</td>
<td>88.24</td>
</tr>
<tr>
<td></td>
<td>20th of May</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>17.24</td>
<td>14.81</td>
<td>0.47</td>
<td>85.90</td>
</tr>
<tr>
<td>105</td>
<td>15.47</td>
<td>12.74</td>
<td>0.47</td>
<td>79.70</td>
</tr>
<tr>
<td>213</td>
<td>16.84</td>
<td>11.85</td>
<td>0.12</td>
<td>89.69</td>
</tr>
<tr>
<td>234</td>
<td>18.27</td>
<td>16.59</td>
<td>0.18</td>
<td>90.80</td>
</tr>
<tr>
<td></td>
<td>3rd of June</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>15.51</td>
<td>14.09</td>
<td>0.24</td>
<td>89.32</td>
</tr>
<tr>
<td>105</td>
<td>16.06</td>
<td>13.51</td>
<td>0.29</td>
<td>82.18</td>
</tr>
<tr>
<td>213</td>
<td>18.15</td>
<td>16.18</td>
<td>0.18</td>
<td>89.14</td>
</tr>
<tr>
<td>234</td>
<td>18.75</td>
<td>17.17</td>
<td>0.13</td>
<td>91.57</td>
</tr>
</tbody>
</table>

From these very complete results it may be readily appreciated that the P. O. J. 105 is not only far from such early maturity as the P. O. J. 234, which is a notably early-maturing cane, but is also consistently inferior to both P. O. J. 36 and 213, not only in earliness of maturity, but in sugar content and purity as well.
THE P. O. J. CANES IN PORTO RICO

It would appear that to Prof. D. W. May of the Federal Experiment Station in Mayagüez is due the credit for the introduction of most of the P. O. J. canes we are considering in this paper into "The Isle of Enchantment." From the Sugar Experiment Station

in Tucumán we sent in 1915, along with the first sending of Uba cane, which was afterwards repeated on a hitherto unprecedented scale (57), P. O. J. 36 and 234, and in 1921 the Tucumán Station sent a few seeds of the P. O. J. 213 to the Insular Experiment Station of Porto Rico. It would seem (101) that the P. O. J. 105
was brought from Egypt by Mr. May a number of years ago, although little attention was paid to it until after the discovery by Earle of its extreme resistance to Mosaic Disease and, like the other three \( P.\ O.\ J. \) canes here considered, to root diseases, although in both cases it shows more effects of disease than either the \( P.\ O.\ J. 36 \) or \( 213 \). Mr. Antonio Fraticelli, manager of Central "Los Caños," to whom the author is indebted for a large part of the data which he has been able to obtain on the Java canes in Porto Rico, tells us that, when he went as manager to Central "Córscia" in 1917, he found a few stools of the \( P.\ O.\ J. 105 \) which had been practically abandoned. Struck by its good development with practically no attention being given to it in a cultural way, he began extending this cane and, as passing planters began to notice its growth and appearance, he received many requests for seed, which were generally granted. It is very probable, from what we have been able to discover, that the wide extension of this cane in Porto Rico dates from the finding of these stools by Mr. Fraticelli.

Despite the fact that there are large areas of the \( P.\ O.\ J. 105 \) planted all over the Island, with smaller amounts in order of their naming of \( P.\ O.\ J. 36, 213 \) and \( 231 \), it has been very difficult to obtain data from plantings of these canes in comparison with each other or with other standard canes. Naturally, isolated data of yields or chemical analyses without some basis of comparison with another variety under similar conditions are of very doubtful value in forming an opinion of the relative merit of any cane varieties: hence the amount of data furnished on these canes in Porto Rico may appear to be rather disappointingly small.

Mr. May has kindly furnished the following data of yields from the Mayagüez Experiment Station, the cane being 16-17½ months plant: \( P.\ O.\ J. 36, 5213 \) tons per acre; \( 105, 42 \) tons: \( 132 54.9 \). Mr. E. H. Barrow sent us the following:

**Table X**

<table>
<thead>
<tr>
<th>Hacienda</th>
<th>Variety</th>
<th>Class</th>
<th>Tons per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altagracia</td>
<td>( P.\ O.\ J. 36 )</td>
<td>Gran Cultura</td>
<td>( 45.0 )</td>
</tr>
<tr>
<td>Trinidad</td>
<td>( P.\ O.\ J. 36 )</td>
<td>1st. Ratoon</td>
<td>( 18.8 )</td>
</tr>
<tr>
<td>Pagán</td>
<td>( P.\ H. 10(12) )</td>
<td>3rd. Ratoon</td>
<td>( 25.5 )</td>
</tr>
<tr>
<td>Pagán</td>
<td>( P.\ O.\ J. 105 )</td>
<td>1st. Ratoon</td>
<td>( 53.0 )</td>
</tr>
<tr>
<td>Cipriana</td>
<td>( P.\ O.\ J. 105 )</td>
<td>1st. Ratoon</td>
<td>( 30.0 )</td>
</tr>
</tbody>
</table>
Mr. R. L. Page, manager of cultivation for Russell & Co., wrote under date of 16th January, 1924, regarding the P. O. J. 36 around Añaseo, as follows:

"We have been farming this cane in Añaseo for the past three years and find that under reasonably good conditions it gives from 40 to 50 tons as ratoons.

We have cut second ratoons as high as 38 tons. This cane is somewhat sweeter than the Uba cane and when left to reasonable maturity ranges between 13 and 16 per cent sucrose."

Mr. Fraticelli has been kind enough to furnish us the following comparative yields from "Los Caños":

We have cut second ratoons as high as 38 tons. This cane is somewhat sweeter than the Uba cane and when left to reasonable maturity ranges between 13 and 16 per cent sucrose."
Table XI
Comparative Production at Central "Los Cafios" of Rayada and P. O. J. Canes

<table>
<thead>
<tr>
<th></th>
<th>Rayada</th>
<th>P. O. J. 105</th>
<th>P. O. J. 105</th>
<th>P. O. J. 103</th>
<th>P. O. J. 103</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist. 1</td>
<td>38.55</td>
<td>50.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dist. 2</td>
<td>18.00</td>
<td>41.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dist. 3</td>
<td>14.18</td>
<td>40.93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mr. Fraticelli has also put at our disposition a number of comparative analyses from Centrals "Coloso" and "Los Caños." The following represents an average of three analyses each of P. O. J. 36 and 105, "gran cultura" from Finca Carlota near Rincón, ground in Central "Coloso" in January of this year and an average of two analyses of P. O. J. 234 "gran cultura" of the same origin and ground in the same Central in February.

<table>
<thead>
<tr>
<th></th>
<th>Sugar</th>
<th>Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>16.55</td>
<td>83.06</td>
</tr>
<tr>
<td>105</td>
<td>15.05</td>
<td>85.88</td>
</tr>
<tr>
<td>234</td>
<td>16.05</td>
<td>89.77</td>
</tr>
</tbody>
</table>

The following analyses were made at "Los Caños" of "gran cultura" cane on the 23rd of January last: all from good lowlands:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Brix</th>
<th>Sugar</th>
<th>Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rayada</td>
<td>11.81</td>
<td>12.15</td>
<td>81.90</td>
</tr>
<tr>
<td>P. O. J. 36</td>
<td>17.12</td>
<td>14.38</td>
<td>87.51</td>
</tr>
<tr>
<td>P. O. J. 105</td>
<td>15.63</td>
<td>12.44</td>
<td>82.87</td>
</tr>
</tbody>
</table>

The next two analyses were made at "Los Caños" the next day:

| P. O. J. 36 | 16.81 | 14.37 | 88.25 |
| P. O. J. 105| 16.51 | 12.48 | 78.60 |

Finally, through the kindness of Mr. Andrés Oliver, of Central Cambalache, the writer secured the following comparative analyses of twelve-month plant cane made in that central on the 3rd of April last:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Brix</th>
<th>Sugar</th>
<th>Purity</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. O. J. 105</td>
<td>18.00</td>
<td>14.87</td>
<td>82.61</td>
</tr>
<tr>
<td>P. O. J. 234</td>
<td>16.65</td>
<td>14.33</td>
<td>88.07</td>
</tr>
</tbody>
</table>

* Called 36 at Cambalache.
Conclusions

From the small amount of data on cultural yields and chemical analyses which we have been able to obtain under comparative Porto Rican conditions, we find that on "The Isle of Enchantment", these four P. O. J. canes seem to have behaved in a manner surprisingly similar to that displayed in Tucumán. In Tucumán we found that the P. O. J. 36 and 213 had outdistanced all other canes in yield of cane and sucrose per acre, as well as in resistance to their 100 per cent infection with Mosaic Disease and to various root diseases. As an early maturer P. O. J. 231 was superior to all others, but its
cultural yield was never as high, nor does it last in Argentine so many years as stubble. The P. O. J. 105 in all Tucumán tests certainly stood at the bottom of three other sister canes in point of cultural and factory yield, long ratooning, maturity and resistance to Mosaic and other diseases. A glance at the Mayagüez results will show that P. O. J. 36 and 213 have outdistanced the "Egyptian" in yield of cane per acre by over 10 and 15 tons, respectively, while the highest yield recorded in the field from Añasco is also for the P. O. J. 36. While actual comparative data is lacking from "Los Caños", personal inspection by the writer has shown both the P. O.

FIG. 11.—Ratoons of P. O. J. 234 at Central "Los Caños", Arecibo. Note adventitious roots characteristic of this early-maturing variety
J. 36 and 213 to be superior to the P. O. J. 105 in general condition in the field. The "Coloso" analyses of P. O. J. 36, 213 and 234 show that the P. O. J. 105 has over a point less sugar than the other two varieties, while the "Los Caños" analyses show the P. O. J. 36 about two points in sugar and over five points in purity ahead of the P. O. J. 105. Finally the Cambalache data show a superior purity of some 3½ points for P. O. J. 213 over P. O. J. 105.

Why, then, is the so-called "Egyptian" cane so much more extensively cultivated in Porto Rico than any of the other three varieties, particularly the P. O. J. 36 and 213? The answer is hard to find except upon the grounds that the seed of the former was more easily obtainable when interests was awakened in this class of cane at the time of the outbreak of Mosaic on the West Coast and planters have learned to know this variety while seldom seeing the others herein discussed.

A Word of Warning

The writer would certainly advise Porto Rican planters cultivating the P. O. J. 105, or "Egyptian" cane in Mosaic Disease sections to at least try out the other three P. O. J. varieties discussed in this paper under the conditions of their own particular properties and in direct competition with each other, as well as with other varieties in the trial of which they might be interested. The data obtained in both Argentine and Porto Rico would certainly indicate that they are cultivating about the poorest of the prominent P. O. J. canes and if they verify this indication in their own fields the course to follow will be plainly seen. The cost of cultivation is about the same for these canes whether one obtains a large crop or a comparatively small one and an extra yield of ten or fifteen tons per acre so enormously reduces the ton cost of cultivation that it would seem that such trials would be well worth while.

However, the writer wishes to point out most unequivocally that HE IS NOT RECOMMENDING ANY OF THESE CANES FOR CULTIVATION WHERE AN EFFORT IS BEING MADE TO CONTROL MOSAIC, as all figures herein given for the P. O. J. canes are for cane 100 per cent infected with Mosaic. While Mosaic does not seriously affect the vigor of these particular canes, their introduction into comparatively clean areas would be fatal, as they would serve as foci of infection for all surrounding fields. There are, however, considerable extensions of territory in the earlier infected sections of the
FIG. 12.—Looking down a road between two remarkable fields of P. O. J. 36 at Central "Los Caños"
Island where planters have decided to follow the same policy as was followed in Argentine in solving its Mosaic Disease problem—i.e., planting only the tolerant varieties and eliminating the susceptible ones. In such districts—and in such districts only—we can thoroughly recommended a trial of the lesser-known P. O. J. 36, 213 and 234 canes and if results prove that any or all of the three, under the particular conditions of the experiment, are superior to the P. O. J. 105 already in cultivation, then it would seem the part of wisdom and common sense to gradually replace the P. O. J. 105 with the higher yielding, sweeter, hardier and more early maturing variety or varieties indicated by such tests. We have seen that the P. O. J. 36 and 213 have meant millions of dollars in the pockets of the Argentine planters and central owners—it is by no means impossible that they may have a similar significance for Porto Rico.
APPENDICES

A. The Fiber Content of the P. O. J. Canes and its Significance.
B. Descriptions of the P. O. J. Canes Discussed in this Paper
C. An Annotated Bibliography of P. O. J. Canes.
THE FIBER CONTENT OF THE P. O. J. CANES AND ITS SIGNIFICANCE

A frequent objection that is made to the P. O. J. canes is the difficulty of milling them on account of the higher fiber content, as compared with the Rayada or Cristalina type of cane. On the other hand, many persons of experience consider that the higher fiber content of these canes, instead of being a disadvantage, is a very decided point in their favor, taking into consideration the increased resistance of the higher fiber-content canes against the attacks of the common moth cane borer, Diatraea saccharalis, and the additional amount of bagasse supplied by these canes for the furnaces.

The following table gives the fiber contents of the four P. O. J. canes discussed here, in comparison with the Rayada. All but the analysis of the P. O. J. 105 which was made by Mr. Francisco López Domínguez, Chief Chemist of the Insular Experiment Station, represent the averages of a number of fiber determinations made at the Tucumán Sugar Experiment Station.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Per cent fiber in canes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. O. J. 36</td>
<td>12.80</td>
</tr>
<tr>
<td>105</td>
<td>13.27</td>
</tr>
<tr>
<td>213</td>
<td>13.00</td>
</tr>
<tr>
<td>234</td>
<td>12.20</td>
</tr>
<tr>
<td>Rayada</td>
<td>10.60</td>
</tr>
<tr>
<td>Average P. O. J.</td>
<td>12.82</td>
</tr>
</tbody>
</table>

It will be observed that all of the Java varieties run very considerably higher in fiber than the Rayada, averaging a 21 per cent increase.

**Effect on Borer Infestation**

The increased fiber content of these canes, which is particularly manifested in additional hardness of the rind and internodes, makes penetration into the inner tissues of the cane by the moth borer a very much more difficult matter than in such canes as Rayada, Cristalina or Santa Cruz 12 (4) and, probably more important yet in its effect on the composition of the juice and in the reduction in
extraction which follows heavy borer attack, is the fact that, whereas
the borer, once its tunnel is started in the softer canes, will perforate
several joints, in these harder canes it has been found that, in
stubble cane particularly, they seldom pass the node immediately
above them and their attacks, hence, are in the majority of cases

![Image](attachment:image.png)

FIG. 13—Java 36 (P. O. J.)

confined to one joint. In Tucumán we found that the average joint
infestation with *Diatraea* in the native *Rayada* type of cane was
41.3 per cent over a series of years, while that for the *P. O. J.*
canes 36, 213 and 234 averaged just about 15 per cent. Barber (8)
gives a large number of comparative analyses from the Audubon
Park Experiment Station showing a great reduction in the manu-
facturing value of cane juices from severely attacked canes and
Van Dine figured out this loss in Porto Rico at 670 pounds of sugar
per acre. Using Van Dine’s figures as the average for the Island,
Jones (141) figured out an annual loss to the Porto Rican sugar
growers at over 32,700 tons, which, calculated at but $77.50 per ton,
would represent a value of over two and one-half millions of dollars.
Could we cut this loss down in the same proportion as the P. O. J.
canes are less infested with borer than the thicker, softer canes—
over 60 per cent on the average—it well be seen that the acre-profit
would be quite substantial.

**Effect on Milling Results**

Despite the many opinions to the contrary which one frequently
hears expressed, there is no doubt that, with proper adjustment of
the crusher rolls and the necessary changes in the feed to meet the
conditions of a thinner cane with decidedly higher fiber content—
which means, of course, that a layer of the P. O. J. cane of the usual
depth on the conductor will contain more fiber and, hence, offer
more resistance to the mills than is indicated by the comparison of
the fiber contents of the P. O. J. canes and the Rayada or Cris-
talina, since the thinner canes fit more closely together and a con-
siderably greater weight of cane will pass over the conductor than
with the same thickness of layer of the thicker canes—very good
milling results can be obtained from these canes, although their
higher fiber content does undoubtedly signify a certain amount of
reduction in the grinding capacity per hour of any properly ad-
justed milling plant and a probable small decrease in extraction
under normal conditions (169).

In studying this question the writer a number of years ago,
making use of the very complete Mutual Control Reports from Java,
compiled the comparative manufacturing figures for two sets of
sugar mills in that progressive island—one lot representing the
twenty-three plants which for the entire crop of 1912 ground cane
with an average fiber content of above 13 per cent, corresponding to
the content of the P. O. J. seedlings we have been discussing, and
the other representing the 17 factories which that year ground cane
averaging less than 11 per cent fiber, which compares quite well
with our Rayada and Cristalina. The results found in the Table
below are extremely interesting.
TABLE XII

Results Obtained in Java from Factories Grinding Cane of High and Low Fiber Content

<table>
<thead>
<tr>
<th>Fiber in cane</th>
<th>No. Factories</th>
<th>% suc. in cane</th>
<th>% suc. extracted on 100% cane</th>
<th>% juice extracted on 100 parts juice</th>
<th>Fiber in cane</th>
<th>Bagasse</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellow 11</td>
<td>17</td>
<td>12.50</td>
<td>11.49</td>
<td>91.3</td>
<td>10.58</td>
<td>4.73</td>
<td>48.45</td>
</tr>
<tr>
<td>Above 12</td>
<td>28</td>
<td>12.29</td>
<td>11.68</td>
<td>90.3</td>
<td>13.61</td>
<td>4.39</td>
<td>44.38</td>
</tr>
</tbody>
</table>

There was little difference, then, between the results obtained by the two groups, the most important one from the calorific standpoint being that the bagasse from the high-fibered cane had 3½ points less humidity than that from the mills grinding canes of low-fiber content. The average per cent sucrose in cane was slightly better in the group of centrals grinding low-fiber cane and they obtained one point better extraction than the mills grinding cane of high-fiber content, losing, also, slightly less fiber in the bagasse.

This table seems to make further discussion of the milling of the P. O. J. canes unnecessary as mechanical practices, unlike agricultural ones, can be pretty well applied in any country and there is no satisfactory reason why milling results achieved with these canes in Java should not be duplicated in the very well equipped centrals of "The Isle of Enchantment".
APPENDIX B

TECHNICAL DESCRIPTIONS OF THE P. O. J. CANES

Very shortly after the recognition of the fertility of cane seed in 1888-89 by Harrison and Bovell in Barbados and Soltvedel in Java, working completely independently, extensive breeding of varieties was commenced by Kobus and Walder at the Oost Java Proefstation, the Indian cane Chunnee (one of the Ukh class) being employed as the male parent and the Black Cheribón and Striped Preanger (our Morada and Rayada) as the female. This combination was used with the object of obtaining a "hybrid" with the serreh-resistant qualities of Chunnee and the very desirable cultural and manufacturing characteristics of the female parents, then in common cultivation in Java. All of the four canes which we have been discussing belong to this series and partake of the characteristics of the majority of the varieties produced by these crosses, i. e., they all have narrow leaves, long thin joints, extremely hard rind and a modified central fistula. The following short descriptions are based on those of Jeswiet (138-9) and Fawcett (109). The colors mentioned therein refer only to the mature cane and the male parent is given first in each case in referring to the parent canes.

P. O. J. 36. Chunnee X Striped Preanger.—Stalk light-green yellow, overlaid with rose, later with rose splashes. Numerous rind fissures visible as rose-colored stripes, no growth fissures. Wax layers distinct in younger joints, later remaining as black patches. Joints very zigzag, cylindrical concave on eye side, convex on opposite, 5 mult 1 inches. Pith dense, coarse, with small fistula. Rind very thick and hard. Growth ring very wide, horizontal, bulging slightly above eye, often with a rose-colored border. Root ring inverted cone or cylinder, 2-3 rows of roots, dark yellow, often ringed purple. No eye channel. Eyes broad, almost elliptical, compressed, upper part wide, lying close to the stalk. Germinating point nearly central, nervature almost radial. Group hairs 1, 2, 3, 4, 7, 8, 10, 12, 14, 18, 19, 21 constant; 5, 6, 11, 22, 25, variable. Leaf sheath 12 to 13 inches long, with small, inconspicuous ridge. Inner auricle always and outer sometimes present. Ligule broad, bow-shaped over eye. Leaf dark green, 3.9-4.1 cms. wide, leaf callus olive green.
with yellow margin. Group hairs 51, 52, 53, 54, 57, 58, 60, 61, 64, 66, 70, 71.

P. O. J. 105. Chunnee X Black Cheribún.—Old stalks rose-colored under wax layer, the color being diffused and disposed in indistinct fine lines over brown base. Due to the thick wax coating this color appears to be a clear grey or almost violet, the character-

![Image](http://example.com/image.png)

FIG. 14—Java 105 (P. O. J.)

istic color of this variety. Prunose ring notable for its entire lack of red color and for its slight construction. Joints somewhat zig-zag, long, the younger ones cylindrical; in the older ones the eye side is straight and the opposite side slightly convex, the lower joints being somewhat inversely conical. Pith dense, with thick fibers. Rind hard, but not so thick as in the P. O. J. 36. Growth ring with fundamental color of joints, sometimes slightly constricted,
but never swollen. Root ring somewhat narrower at the top in the 
upper joints and convex and swollen in the lower ones; rudimentary 
roots almost same color as the base on which they appear, this being 
of a dark red color in the middle joints. The color of this zone is 
at times rather rosy and becomes darker upon exposure to light; 
also covered with wax; rudimentary roots tenuous and persistent. 
Well developed eyes broad, elliptical and compact, upper part 
widely alate and slightly pointed, the angle of the germinating point 
obluse and the edges of the "wings" slightly dentate. The eyes 
just exposed to the sun are purplish toward the germinating point, 
which is found at the upper center of the eye. At first the buds 
are flattened, later becoming convex. The interior edge of the 
"wing" has some small hairs (4), with groups in the exterior angles 
(26). The "wing" itself is covered with short, fine, black or white 
hairs (12), while the basal belt (1 and 2) of white hairs is always 
present, although the hairs are relatively sparse. Nervature free 
of pubescence. In the exterior angles of the "wing" covered with 
short black hairs (21), these also being found on the upper part of the 
eye (23), where they are mixed with long white hairs (10). At 
the base are found at times external groups, (19) which combine 
with group 18. Groups 1, 2, 16, 4 of the external side and 18 
and 19 of the internal are almost always present, the others at times 
being lacking. Leaf sheath dark green, pruinose and smooth except 
at base, where there are occasionally found some short hairs (58). 
Leaf scars oblique. Inner auricle lacking, exterior small (5 mm. in 
length) or lacking. Ligule narrow. Ring yellowish or greenish, 
with fine white or black hairs, which unite with the groups which 
are found on the nervature and which are not numbered. Leaf 
dark green, long and narrow, basal leaf callus green and covered 
with fine white pubescence (52). The hairs are longer along the 
edge (51) on the upper side. The lower side, besides being 
pubescent (58), is somewhat pruinose.

P. O. J. 213. Chunnee X Black Cheribón.—Stalk dark purple 
to brown red. Rind fissures in older joints, no growth fissures. 
Wax layer at first plain and thick, diminishing with age, wax 
ring sharply defined. Joints slightly zigzag, cylindrical, slightly 
concave on eye side, convex on opposite, 6 to 9 by three-fourths to 
one inch. Pith smooth, often with a fistula, rind hard. Growth 
ring horizontal, wide, smooth, yellow splashed with red. Root ring 
cylindrical, more or less concave, broader than stalk, dark brown.
with yellow margin. Group hairs 51, 52, 53, 54, 57, 58, 60, 61, 64, 66, 70, 71.

P. O. J. 105. Chunnee X Black Cheribón.—Old stalks rose-colored under wax layer, the color being diffused and disposed in indistinct fine lines over brown base. Due to the thick wax coating this color appears to be a clear grey or almost violet, the character-

![Image](image-url)

**FIG. 14—Java 105 (P. O. J.)**

istic color of this variety. Pruinose ring notable for its entire lack of red color and for its slight construction. Joints somewhat zig-zag, long, the younger ones cylindrical; in the older ones the eye side is straight and the opposite side slightly convex, the lower joints being somewhat inversely conical. Pith dense, with thick fibers. Rind hard, but not so thick as in the P. O. J. 36. Growth ring with fundamental color of joints, sometimes slightly constricted,
2 rows of roots. Eye channel almost always absent, distinguishable in older cane as a flattening. Eye elongated egg-shaped, triangular point, broad wing, very flat, germinating point apical, nervature converging to top. Hair groups 1, 2, 12, 19, 21, and 26 constant, 10 and 11 variable. Leaf sheath 11 inches long with fissures one-half inch long. Auricle almost always absent, small and stumpy.

**FIG. 15.—Java 213 (P. O. J.)**

Central Cambalache

Ligule very wide and smooth. Leaf 1\(\frac{1}{2}\) inch wide, callus yellow-green, waxy. Hair groups 51, 52, 53, 54, 57, 60, 61 and 62.

*P. O. J. 231.*—Lowler joints green tinged with purple, upper yellow-green with thin brown striping, wax layer thick. Rind thinner than in other canes above described. Growth ring bronze where exposed and pale green or yellow in upper joints. Two or
FIG. 16.—1. Java 106 (P. O. J.); 2. Java 213 (P. O. J.); 3. Java 36 (P. O. J.)
three rows of roots. Wax ring narrow and in lower joints thickly covered with wax. Eye channel conspicuous in middle joints. Eye narrow, semicircular below, upper part making an angle of a little less than 90 degrees. Germinating point almost apical, nerves fine and numerous. Hair groups 1, 3, 12, 21, 23, and 26 constant, 2, 10, 16, 18 and 19 variable. Inner auricle when present is 1–2 mms. long. Outer auricle 5–10 mms. long, always present. Leaf long, narrow, dark green, callus pale yellowish green.
APPENDIX C

AN ANNOTATED BIBLIOGRAPHY OF THE P. O J. CANES

Abbreviations.—Three journals which are repeatedly quoted in this list are abbreviated therein as follows:

Revista Industrial y Agrícola de Tucumán (Argentina)—Rev. Tuc.
Mededelingen van het Proeftuinen voor de Java-suikerindustrie—Med.
International Sugar Journal of London—J. S. J.

AGEE, H. P.

(1) The Propagation of New Cane Varieties from Seed. La. Planter; April, 1911. Mentions, in a detailed review of varietal work at the Audubon Park Expt. Sta., importation of POJ 234 into Louisiana from Tucumán, (Argentina) Sugar Exp. Sta., but lack of later mention in La. Repts. would indicate that it was never extensively tried out there.

(2) Resistance to Disease and Adverse Agricultural Conditions by Hardy Sugar Cane Types. Rept. of Committee in Charge of Expt. Sta. to Hawaiian Sugar Planters’ Assn., Sept. 7, 1923. Recent collapse of standard sugar-cane varieties in Porto Rico through attacks of Mosaic and root diseases have brought this subject into much prominence. Earle’s list of varieties more or less immune to root diseases, in which he singles out POJ 36, 105 and 234 as immune, is referred to. Reference is also made to the rehabilitation of the Argentine sugar industry by the introduction and extension of POJ 36 and 213 and to the introduction of POJ 36 into Formosa & J. 105 into Egypt with striking results.


ANDINO, A. M. DE, Y COLÓN, EDUARDO


ARANGO, RODOLFO

(5) La Enfermedad de las ‘‘Rayas Amarillas’’ o ‘‘Mosaico’’ en la Caña de Azúcar. La Hacienda, pp. 106–9, Ene., 1921. Quotes some figures, probably erroneously, from Rev. Tuc. on yields of Uba compared with POJ canes.
AVILA, JULIO P.

BARBER, C. A.
(7) Cane-Breeding in Hawaii. I. S. J., XXVI, pp. 245-9; May, 1924. Review of recent work in Hawaii. "Cane varieties and seedlings raised in Mauritius, Barbados, Java, Demerara and other countries, have been spread all over the world and have in many cases given a fresh impetus to the sugar industry but we nowhere meet with forms of such wide distribution as the old Bourbon, which presumably was not a seedling.''

BARBER, T. C.
(8) Damage to Sugar Cane in Louisiana by the Sugar-Cane Borer. U. S. Bur. Entomology, Circ. 139, p. 12; 1911. Gives numerous analyses of infested and borer-free cane at Andubon Park Experiment Sta. and shows in every case heavy deterioration to manufacturing value of juices due to borer attack and inversion and disease following thereafter.

(9) Trabajos Proyectados con Insectos de la Caña. Rev. Tuc., III, pp. 95-102; agosto, 1912. "In the main and substations a number of foreign varieties of sugar cane are now being tried out . . . . These will be carefully observed . . . with the object of determining if the damage caused by insects varies with distinct varieties and different climatic conditions.''


BENNETT, A. G.
(11) Informe de Subestaciones para el Año 1914. Rev. Tuc., V, pp. 202-19; Oct., 1914. In Monte Bello POJ 36 yielded 35 tons cane per hect., 213 gave 55½ and 234 yielded 23½ tons in comparison with 15 tons for the Rayada. In San Pablo the yields per hectare were, for the POJ 36, 59 tons, and for the 213, 65½ tons, in comparison with the very good yield of 39 tons for the Rayada. In this expt. POJ 234 lead all other varieties (14 in number) in sugar content of juice —19.42%— the Rayada showing 16.37%. POJ 105 yielded 50 tons cane per hect., with 16.37% sucrose in juice and a purity of 81. In Aguilares POJ 36 lead the 7 varieties tried with 90 tons cane and 7 tons sugar per hect. In Luján POJ 213 lead with 83 tons cane and 6½ tons sugar, an exceptional yield for that dry section.
BLOUIN, R. E.

(12) Variedades de Caña. Rev. Tuc., II, pp. 73-115; 1911. Gives results from first crop of POJ and some 200 other varieties harvested in the Tucumán Sugar Expt. Sta. Lists POJ 36, 213 and 234 amongst the 20 varieties so far giving superior results to those obtained with the staple cane of the country, the Rayada.

(13) Estudio de Nuevas Cañas. Rev. Tuc., II, pp. 214-7; 1911. Letter to Mr. Carlos R. Hamakers, who had offered to secure large quantities of the POJ canes for Tucumán on a visit to Java, advising against any such wholesale and expensive importation on the basis of such short experience in the Tucumán Sugar Expt. Sta. with these canes.

(14) Informe sobre los Trabajos Efectuados en la Estación Agrícola durante 1912-1913. Rev. Tuc., III, pp. 417-506; 1913. Includes verbatim ad literatim Rosenfeld’s “Diez de las Cañas Más Prometedoras” (166) and Barber’s “Trabajo de las Subestaciones” (10).

(15) Una Comparación de los Resultados de los Ensayos con las Cañas de Java con los de las Cañas “Kavangire”, “Zwinga” y Morada y Rayada del País. Rev. Tuc., IV., pp. 141-50; Sept., 1913. Interesting comparison of three years results with these varieties. Classifying results as second ratoons, POJ 213 and 234 stood at head of list as regards percentage sucrose in juice, Zwinga and Kavangire (Uba) lead POJ 213 and 36 in yield of cane per acre and Zwinga surpassed POJ 213 in total sugar produced per acre. In fiber content Uba lead all varieties with 13.1% and also showed most rapid inversion after cutting—dropped from 83.4% purity to 25.4% in 12 days.


BLOUIN, R. E., & ROSENFELD, ARTHUR H.

(17) Memoria sobre los Trabajos y Progresos de la Estación Exptl. Rev. Tuc., I, 11, pp. 1-47; Abr., 1911. “Some of these varieties give considerable promise, especially some of the Java seedlings.”


(19) Informe sobre los Trabajos Efectuados en la Estación Exptl. Agrícola durante 1913-14. Rev. Tuc., IV, pp. 369-481, 1914. Very complete report on Sta. work to date, including list of all articles on varieties published in Rev. Tuc. from the first no. in June, 1910. These
are 10 in number, by Blouin, Zerban, Rosenfeld and Hall. POJ 36, 213 & 234 show up strikingly well in this rept. in the central station as well as in the substations.

**Brandes, E. W.**


**Calvino, Eva Mameli de**

(21) Estudios Anatómicos y Fisiológicos sobre la Caña de Azúcar en Cuba. Estn. Exptl. Agronómica de Cuba, Bol. 46, p. 5; Abr., 1912. "The Java cane industry subsists only as a result of the new seedlings obtained and selected by its experiment stations. The same is the case in the British West Indies, in Demerara, in Argentine Republic, etc."

**Cross, W. E.**

(22) El Contenido de Fibra y el Problema de Combustibles. Rev. Tuc., V, pp. 197–8; Oct., 1914. In a most interesting little note gives fiber content in Tucumán of various POJ and other canes and concludes that high fiber content of the former will help to reduce wood consumption in the furnaces of the centrals. "The new varieties which have given the most promise in the Experiment Station as regards tonnage and sugar content have comparatively high fiber contents, being equal in this respect to the very best varieties which are today being widely cultivated in Java and Hawaii."

(23) Algunos Resultados de la Introducción de Variedades Extranjeras. Rev. Tuc., V, pp. 271–3; Nov., 1914. Short review of work of producing and introducing new sugar-canes varieties in various countries, particularly of the work of Kobus, the producer of the POJ canes, and the extension of these varieties to other countries.

(24) La Cosecha de las Nuevas Variedades de Caña. Estación Exptl. Agr. de Tucumán (Argentina), Circ. 2, p. 2; Feb. 1916. Calls attention to rapid inversion of POJ canes after cutting and advises their very prompt delivery to factory.

(25) Memoria de la Estn. Exptl. Agrícola correspondiente al Año 1915. Rev. Tuc., VI, pp. 463–89; Abr., 1916. Rept. as Acting Dir. in absence of Director Rosenfeld. In regard to varieties says, "A complete rept. on this work was compiled by the Director, Mr. A. H. Rosenfeld, and published in a special no. of the Revista ... As a result of five years of study of the Java canes the conclusion was reached that the POJ 36 is the best
variety from every standpoint and the cane destined to replace the native (Rayada) in the province. The next cane recommended was the POJ 213, third choice going to the POJ 23d.'

(26) Un Progreso Epocal en Tucumán. Rev. Tuc., VI, pp. 502-5; Abr., 1916. Considers that successful work of Tucumán Sugar Expt. Sta. with varieties, especially the results from and rapid extension of POJ 36 and 213, places Tucumán, in spite of its rather unfavorable climate and subtropical conditions, in a position where its yields of cane and sugar per acre can compare favorably with the averages in countries much more favorably located for cane growing.

(27) Renuncia del Síñor. Arturo H. Rosenfeld. Rev. Tuc., VII, pp. 91-4; Agst., 1916. "The Station's field experiments were under the direct personal charge of Mr. Rosenfeld for many years and he is responsible for the prolific experimentation with the Java seedling canes, which were carefully and exactly studied from every angle before being definitely recommended to the planters of the province . . . It was logical that, as he was the person who had had the most experience with these Java canes and who best understood the most effective and cheapest methods of planting and cultivating them, he should be the technologist called to scientifically direct the large-scale renovation with these seedlings."


(29) Repartición de Cañas de Java y Caña Forrajera. Rev. Tuc., VII, pp. 153-9; Sept., 1916. "The remarkable results from the Java canes which have been under the study of this institution for seven years and have been strongly and definitely recommended by the Station . . . have had as a result the planting on a truly enormous scale of said varieties all over the province."

(30) Programa de las Experiencias Agrícolas a Realizarse desde Agosto, 1916, hasta Agosto, 1917. Rev. Tuc., VII, pp. 265-72; Die., 1916. Well-laid-out plan of agricultural work for year, with plan of experimental fields including 'the careful study of the Java and forage canes as regards their characters of growth and resistance to drought and disease.'

(31) Noticias de la Estación. Rev. Tuc., VII, pp. 292-3; Die., 1916. Reports that Station is continuing importation of promising varieties of cane from all parts of the world. It is thought that results even more successful than those obtained with the Java canes should result
from the continual trying out of new varieties in care-
fully planned experiments.''

(32) Variedades de Caña en la Estación Experimental. Rev.
Tuc., VII, pp. 311–25; Ene., 1917. "In the November,
1915, edition of the Rev. Tuc. (III-6) Mr. A. H. Ros-
enfeld published a detailed study of the results ob-
tained during five years of experimentation with for-
ign varieties of sugar cane. The object of this pub-
lication is to bring up to date the data published on
that occasion by Mr. Rosenfeld by adding the figures
obtained from the crop of 1916.''

(33) Memoria de la Estación Experimental Agrícola corres-
Feb., 1917. "Las Cañas de Java.—The success of the
experimental work realized at the Station with these
canes and the results of five years of careful study im-
pelled us to definitely recommend them in November,
1915. As is well know, they are now replacing the
creole canes in a manner almost without precedent in
the history of the world's sugar industry . . . . The
Experiment Station can now guarantee the success of
the new varieties and of the industry depending upon
them.''

(34) Algunas notas sobre la Plantación de la Caña de Java.
Rev. Tuc., VII, pp. 390–3; Feb., 1917. Cane for plant-
ing purposes should be as fresh as possible, particularly
seed of POJ 36, 213 and 234, which deteriorate very
rapidly not only from manufacturing standpoint but
in germinating power, after cutting. Irrigation should
be given immediately after planting where possible,
above all if cane is somewhat dry when planted, and
the cane planted deep after good soil preparation.
Cane should also be covered as soon as possible after
planting. In case of being forced to plant somewhat
dry cane it would be highly advisable to increase
amount of seed employed per acre.

(35) La Selección de Caña de Azúcar en la Cosecha. Rev.
Tuc., pp. 394–8; Feb., 1917. With advent of POJ
canes in Tucumán province new factors are introduced
into cropping routine and author recommends system
of sampling cane fields to determine maturity before
harvesting each one, these analyses to commence several
weeks before crop. "The advantages of such a system
of study of cane maturity are many. It places the
crop upon a perfectly rational basis, avoids the harvest-
ing of distinctly unripe cane and assures the grind-
ing at he proper time of the most mature fields.''

(36) La Inspección de Plantas Importadas. Rev. Tuc., VII,
pp. 405–16; Mar., 1917. Letter from Director of the
Tucumán Expt. Sta. to the President of the Board of
same calling attention to necessity of a plant-quarantine law for the province. Discusses the replacement of Kayada cane by the POJ varieties and states that some carelessly imported disease or insect might possibly lead to a decline in the value of the latter canes. Lists dangerous diseases and insects susceptible of easy introduction. In compliance with this indication Governor Padilla decreed a plant-quarantine law on the 30th of March, 1917.

(37) Ensayos Cooperativos. Rev Tuc., VII, pp. 435-42; Mar., 1917. Outlines a series of ten proposed co-operative expts., for the basis of which, in the case of sugar cane expts., the POJ 36 and 213 are mainly recommended. Expts. include liming, trash burning, early cutting, use of stubble shaver, varieties, fertilization, amt. seed most advisable for use, spacing and rotation of crops.

(38) Plantación de Caña. Rev. Tuc., VII, pp. 446-7; Mar., 1917. Expts., with Java canes indicate that they should be pltd. as soon as possible after cutting, in furrows recently opened, irrigating, where possible, shortly after pltg. No advantage to be gained by stripping the seed before pltg.

(39) Lista de las Variedades de Caña que se Han Ensayado en la Estación Experimental Agrícola. Rev. Tuc., VII, pp. 451-69; 1917. As inquiries are frequently received as to whether this or that variety has ever been tried at Expt. Sta. it has seemed advisable to publish in one article a complete list of all varieties tried at Sta., with brief observations as to results obtained with each. Discusses POJ 36, 213 & 234 under one heading, observing: "These canes have now come to be the basis of the Tucumán sugar industry, the Creole canes having notably degenerated."

(40) Noticias de la Estación. Rev. Tuc., VIII, pp. 30-3; 1917. Mentions efforts being made by the Tucumán Sta. to obtain flowers of the POJ canes under the more tropical conditions of the northern provinces of the Argentine in order to breed Tucumán seedlings from same.

(41) Pp. 78-80; 1917. Describes irrigation expts. with POJ canes at Tucumán Sugar Expt. Sta., employing standards worked out in Hawaii as to quantity of water required.

(42) Cañas Prometedoras en la Estación Experimental. Rev. Tuc., VIII, pp. 101-6; 1917. Results from some of the more recently imported canes, as well as from a number of those under trial for several years. Amongst the former figure POJ 105 (discussed as Egyptian
Resultados de Caña Soca del Quinto Año en la Estn. Experimental. Rev. Tuc., VIII, pp. 106-7; 1917. Interesting figures from original plantg. of the POJ canes at the Tucumán Sta. As fifth ratoon POJ 213 yielded 87 tons of cane and almost 10 tons sugar per hect. POJ 234 gave 47½ tons cane and nearly 5 tons sugar and POJ 36 showed yields of 45 tons cane and 4 tons sugar.

Tratamiento de la Caña Dañada por las Heladas. Est. Expt. Ag. de Tucumán (Argentina), Circ. 7; July, 1918. Discussion of effect of different degrees of cold on standing cane, particularly on the POJ varieties, considering, also, methods of avoiding or reducing frost damage and the handling of deteriorated canes at the factory.

Tratamiento de la Caña Helada—Notas Adicionales I & II. Rev. Tuc., VIII, pp. 270-7; 1918. Further considerations on this subject, particularly as regards procedure in factory, advisability of alcohol distillation of deteriorated juices, use of frozen cane as forage, etc.

La Caña Java 228. Rev. Tuc., VII, pp. 279-82; 1918. After Fawcett’s definite decision that the two POJ canes cultivated in Tucumán as 139 & 228 were both POJ 228, the POJ 139 having proven a very inferior variety in trials at the Expt. Sta., author publishes results of Rosenfeld’s previous expts. with the POJ 228 in comparison with 36, 213 & 234. “It has proven to be an excellent variety which gives good yields of cane and sugar per hectare. It is somewhat late in maturing.”

Estudios Relacionados con la Experimentación con la Caña de Azúcar. Universidad de Tucumán, Depto. de Investigaciones Agrícolas, No. 5, pp. 1-109; 1918. A series of six lectures given agricultural students. “After five years of variety work the recommendations of the Station have been limited to four varieties which appear advisable for the manufacture of sugar (POJ 36, 213, 228 & 234).”

Informe Anual del Año 1917. Rev. Tuc., IX-1, pp. 1-31; 1918. “The replacement of the Creole cane by the Java seedlings, definitely recommended by the Experiment Station in 1915, can now be said to have been concluded. In fact the crop of 1918 will consist largely (more than 90%) of Java canes.”

Ensayos sobre Plantación de Cañas Java y Criolla. Rev. Tuc., IX, pp. 48-50; 1918. Results of two very interesting experiments to test effects on POJ 36 and
on Rayada of plantg. seed immediately after cutting and of leaving it for up to 9 days before planting (in Tucumán this system of amortiguar seed was once very common). The POJ 36 from old seed gave less than half the cane and sugar per acre produced by the fresh seed, whereas the Rayada results showed no detrimental effects from allowing the seed to dry out for the maximum.

(50) Ensayos sobre Métodos de Impedir la Descomposición de la Caña Helada. Rev. Tuc., IX, pp. 51–6; 1918. Windrowing experiments under Tuc. conditions turned out quite contrary to results obtained in Louisiana practice, the windrowed cane inverting more rapidly in Tucumán than frozen cane left standing. POJ 36, 213 & 234 used in these expts.

(51) Ensayos con Abonos para la Caña de Azúcar. Rev. Tuc., IX, pp. 72–85; 1918. Reviews Rosenfeld’s extensive series of fertilizer investigations with native canes (Rayada) and brings up results to date. Gives results of new series started with POJ 36 & 213, in which potash and phosphoric acid again failed to show any appreciable effect on yield or analyses, while the increased yield from the use of nitrogenous fertilizers would hardly pay cost of these and application of same. Results from liming also proved negative.

(52) El Problema de la Caña Helada. Rev. Tuc., IX, pp. 102–9; 1918. During crop of 1918 Tucumán suffered most severe frosts of her history, the Rayada showing much more severe effects than did the POJ 36, 213 & 234, which proved notably resistant—“Much more resistant than one could have expected from any cane. This resistance is of the greatest value for the Province.”

(53) Experimentos sobre el Deshoje de la Caña. Rev. Tuc., IX, pp. 110–14; 1918. Reviews work done along line of disproving any value from stripping standing cane in Hawaii and Porto Rico and gives results of an exhaustive series of stripping tests in the Tuc. Agr. Expt. Sta. with POJ 36, 213, 228 and 234, which also failed to show any gain in tonnage from this very expensive process.

(54) “Las Cañas de Java” en Java. Rev. Tuc., IX, pp. 152–8; 1919. Study of culture of POJ 36, 213, 228 and 234 in Java, with tables showing acreage of each of these varieties cultivated on the various Java plantations. In very few centrals are any of these canes pltd. on a very large scale, POJ 36 & 213 occupying a maximum of 10% each of the cane area of 8 plantations and only one plantation cultivating POJ 234 (about 20 acres all told).
(55) Las Cañas Tucumanas en la Cosecha de 1919. Rev Tuc., IX, pp. 161-7; 1919. First published results from Tucumán seedling canes. "All these thirty are less fibrous than the Java canes now cultivated in the Province. They are also thicker than the latter."

(56) Los Ensambos con Abonos para la Caña de Azúcar. Rev. Tuc., IX, pp. 170-8; 1919. Fertilizer expts. and results with POJ 36 and 213 in both limed and unlimed soils. Stable manure gave no positive results, nor did sulphate of ammonia show any consistent gains, but both varieties responded readily to green fertilization and crop rotu.


(58) La Desebradora "Searby". Rev. Tuc. IX, pp. 182-4; 1919. Correspondence with Prof. H. P. Agee, Director of the Sugar Planters' Expt. Sta. in Hawaii, et al. in regard to probable usefulness of a shredder on the lines of the "Searby", so much used in Hawaii, for easier handling at the mills of high-fiber content canes like POJ 36.


(60) El Deterioro de las Cañas Cortadas. Estn. Exptl. Agric. de Tuc., Circ. 7, pp. 1-3; 1919. "It is a well known fact that the Java canes commonly cultivated in the Prov. undergo a very notable deterioration after being cut if they are not very promptly ground."

(61) Informe Anual del Año 1918. Rev. Tuc., X, pp. 1-30; 1919. "The Java canes are employed as the basis of the field work of the Station (especially the POJ 36 & 213), having been long since definitely recommended by the Station and being now the basic canes of the provincial sugar indstv."

(62) El Problema de la Caña no Molida. Rev. Tuc., X, pp. 42-5; 1919. Discusses expts. made by Hall and Rosenfeld in leaiving POJ 36, 213 & 234 without harvesting for two yrs. with good results and no deterioration and gives favorable results of further expts. along this line. "The stools of the caña de jada had not suffered any damage whatsoever despite the length of time it stood before crop."

(63) Recientes Resultados con Algunas Variedades de Caña. Rev. Tuc., X, pp. 74-9; 1919. "A variety which has attracted considerable attention in the Province is the POJ 105, first introduced under the name of 'Egyp-
tian Amber.' Results obtained and observations carried out indicate that this cane, although quite a promising variety, cannot in any way compare with the POJ 36 and 213. Generally it gives smaller agricultural yields than the latter, it is more susceptible to disease and is not of such early maturity as was at first thought."

(64) Distancia a que Debe Plantarse la Caña de Azúcar. Rev. Tuc., X, pp. 87-100; 1919. "The practical conclusion arrived at from these results, is, therefore, that POJ 36 & 213 should be planted with the minimum distance between the rows that will permit of implement cultivation. We have found that a distance of 6 ft. allows of easy cultivation with machinery."

(65) La Necesidad de la Rotación de Cultivos. Rev. Tuc., X, pp. 115-24; 1919-20. "The Java canes, even more than the Creole ones, should be rotated, since they produce twice the tonnage given by the indigenous varieties."

(66) El Tratamiento de la Caña Dañada por las Heladas. Rev. Tuc., X, pp. 143-53; 1920. Finds that POJ 36, 213 & 234 are much more resistant to the effects of frost than 105.


(68) Rotación de Cultivos para la Caña de Azúcar. Una Parte Esencial de la Agricultura de la Caña de Java. "Sugar", N. Y., XXII, pp. 683-6; Sept. 1920. "The author desires in this article to call attention to the absolute necessity of adopting, as one of the necessary modifications in cultural methods brought about by the use of the Java canes, the system of crop rotation. Also he may be allowed to state that the Tucumán planters should not object to adopting some such system of agriculture, since the agriculturists of the remotest ages have always recognized such a system as necessary and inevitable."

(69) Informe Anual del Año 1919. Rev. Tuc., XI, pp. 1-44; 1920. "The past year has been the most notable in the history of the Station, since in that period we have seen the absolute justification of the recommendations made by the Station in 1915 (at that time directed by Mr. Rosenfeld) in regard to the substitution of the Creole cane by certain Java varieties. These recommendations have now been carried out all over de Province. The splendid results obtained in
1919 in all parts of the Province constitute the most
eloquent justification of our recommendations.”

(70) Estudio de la Caña Dejada. Rev. Tuc., XI, pp. 85-99; 1920-21. Analyses and studies of POJ 36, 213 & 234 left for two years before harvesting. “It cannot in any manner be said that chemically or technically the caña dejada was not apt for sugar manufacture. On the contrary, it showed high purity, low glucose and good adaptability for the factory.”

(71) Un Ejemplo de la Resistencia de las Cañas de Java a las Heladas. Rev. Tuc., XI, pp. 103-5; 1920-21. Demonstration of the remarkable resistance of these canes to frost.

(72) Distancia a que se Debe Plantar la Caña de Azúcar. Rev. Tuc., XI, pp. 118-21; 1921. Expts. with POJ 36 & 213. “The selection of the best distance between the rows, therefore, must depend upon the factor of economy; the distance should be selected which gives the cheapest production of cane per ton.”

(73) Las Posibilidades de las “Cañas de Java” en Luisiana. Rev. Tuc., XI, pp. 118-21; 1921. Recommends the introduction of these canes into Louisiana and their study under the conditions of that State which are so similar in general to those of Tucumán.


(75) Ensayos sobre Métodos de Plantar la Caña—I. Rev. Tuc., XII, pp. 65-70; 1921. Gives yields of POJ 36 planted en chorro and according to Reynoso system.

(76) Estudios con Variedades de Cañas Importadas. Rev. Tuc., XII, pp. 72-92; 1921. Interesting data on POJ 105 and short bibliography of previous publications in Rev. Tuc. on varieties. Also data on BH 10(12) and D 1135. “The POJ 105 proves to have some very good characters, but is clearly inferior to POJ 36 & 213. We have not been able to confirm its supposed early ripening, of which much was said a few years ago.”

(77) Ensayos sobre Métodos de Plantar la Caña—II. Rev. Tuc., XII, pp. 93-8; 1922. Continuation of (75).


(79) Ensayos sobre el Cultivo de la Caña sin Quemar la Maloja. Rev. Tuc., XII, pp. 103-10; 1922. Expts. with POJ 213. “The most correct conclusion, as is indi-
icated by the average results from the two expts., is that the cane which did not have the trash burned gave the same yield of cane and sugar per hectare as that of which the trash was burned."


(81) La Caña del Lote Fundador de la Estación Experimental. Rev. Tuc., XIII, pp. 211–14; 1923. Gives results through 12th-yr. stubble of original plantation of POJ canes at Expt. Sta. "The varieties POJ 36 & 213 . . . maintained their high yields even in the last years . . . These results demonstrate the long duration of these varieties, i. e., that they can be cropped commercially through many years of ratoons."

(82) Observaciones sobre la Situación de la Industria Azucarera en Louisana. Rev. Tuc., XIV, pp. 8–13; 1923. Compares present situation of Louisiana cane industry with situation existing 15 yrs. ago in Tucumán, before the establishment of the Tucumán Sugar Expt. Sta. and the introduction of the POJ canes. Disagrees with the Rept. of the Comm. on Agr. Progress to the effect that recent poor crops in La. are due to soil exhaustion and thinks that, just as in Tucumán with the Java canes, larger yields were obtained than ever before. Louisiana ought to work in the same direction by fighting Mosaic Disease and working with resistant or immune varieties.

(83) Experimentos con la Caña Criolla. Rev. Tuc., XIV, pp. 16–19; 1923. Discusses replacement of Creole (Rayada) cane in Argentine by POJ 36 & 213 and expts. once more initiated in 1917 to determine if, by abundant fertilization and best cultivation, selected Rayada could be made to compete advantageously with the POJ varieties. The expt., as in previous cases, turned out negatively.


(85) Informe sobre Cañas "Tucumanas" de Semillero. Rev. Tuc., XIV, pp. 37–49; 1923. "Some of the varieties may prove tolerant to Mosaic, in the same manner as are the POJ 36 & 213."
Cross, W. E., and Belile, J. A.
(86) La Deterioración de Cañas Cortadas. Rev. Tuc., V, pp. 277-90; Dec., 1914. An exceptionally profound and completely original study of this problem. Commenced by Hall and brought to successful conclusion by authors. Cane-juice inversion has been attributed to a number of causes by distinct technologists, but this is perhaps the first time that the theory of enzymic inversion has been advanced in this connection—and apparently proven. The question of control of inversion has been carefully investigated by the authors and important experimental data, the basis of much future investigation, was obtained. Authors consider that same enzymic action that is responsible for rapid inversion of Uba and POJ canes is probably cause of rapid and prolific germination of these varieties.

Cross, W. E., & Fawcett, G. L.
(87) La Enfermedad del 'Mosaico' en España. Rev. Tuc., XIV, pp. 80-2; 1923. Interesting correspondence with Planidura Carreras, of Barcelona, in regard to outbreak of Mosaic in Spanish cane-fields. In case of light or localized infection advise roguing and establishment of isolated seed gardens, whereas if infection is more or less generalized advise use of Uba or other immune canes, or such strongly tolerant varieties as POJ 36 & 213.

Cross, W. E. & Harris, W. G.
(88) Deterioración de las Cañas de Semillero de Java después de Cortadas. Rev. Tuc., VII, pp. 219-50; Nov., 1916. An extremely studious and valuable contribution to this subject. The authors conclude that (1) POJ 36, 213 & 234 and Uba suffer a very rapid deterioration upon cutting, (2) these canes should be gotten to factory within 48 hrs. after harvesting, (3) Uba suffers most rapid inversion of above varieties, (4) aside from loss of sucrose in these canes due to delayed delivery, the loss of weight is an important factor and (5) degree of inversion is largely dependent on climatic conditions.

Deerr, Noel
(89) Cane Sugar, publish by Norman Rodger, London, pp. 40-1, 1921. Gives Jeswiet’s and Fawcett’s descriptions of a number of the POJ canes, together with history of their production.

Díaz, Carlos
(90) Poder Calorífico de Algunas Cañas de Azúcar. Universidad de Tucumán (Argentina), Depto. de Investigaciones Agrícolas. No. 7, p. 44; 1918. Emerson calor-
DuREAU, Earle

(91) Seedling Canes. Journal des Fabricants de Sucre, Paris, 1916. Reviews a circular of the West Indies Committee giving hist. of seedling production in West Indies and Java and studies work done by Rosenfeld with POJ canes in Tucumán Expt. Sta. Agrees with Cross that the introduction into and trial of the Java varieties constituted an epoch-making event in the history of Tucumán Province.

EARLE, F. S.

(92) Recomendaciones sobre el Cultivo de la Caña de Azúcar en Puerto Rico. Estn. Exptl. Insular, Circ. 17, pp. 1-24; 1919. One of the few available publications on cane cultivation on the "Isle of Enchantment."

(93) Varieties of Sugar Cane in Porto Rico. Jour. of Dept. of Agr. & Labor, P. R., III, 2, pp. 15-55; Apr., 1919. Describes POJ 36 as J 56, POJ 213 as J 226 & POJ 234 as J 324, all erroneously.

(94) The Resistance of Cane Varieties to Yellow Stripe or the Mosaic Disease. Ins. Expt. Sta. of P. R., Bull. 19, pp. 1-15; 1919. "The two Java kinds (36 & 234), included in the list of selected varieties, are worthy of special mention. They are in no sense immune since they take the disease freely, but they are so tolerant of it or so resistant to its effects that it seems to do them no appreciable damage. Growth is not checked and the foliage is not yellowed, the presence of the disease only being indicated by a faint mottling with different shades of green. No cankers are formed on the canes. These are the two kinds that have come to be planted almost exclusively in the Argentine, where they have replaced the Rayada and the Morada, the kinds formerly planted there."

(95) Eradication as a Means of Control in Sugar-Cane Mosaic or Yellow Stripe. Ins. Expt. Sta. of P. R., Bull. 22, pp. 1-17; 1919. Repts. on one year's highly practical work.

(96) The Year's Experience with Sugar Cane Mosaic or Yellow Stripe Disease. Jour. of the Dept, Agr. of P. R., III, 4, pp. 3-33; Oct., 1919. Gives proper classification of POJ 36, which, confused by Deerr's description (erroneous) as green cane, he had previously (93) called Java 56.

of POJ 36: ‘‘Ratoons stand perfect, condition, best. Almost equally as resistant to root disease as the Kavangire (Uba). These make a class apart in their almost complete immunity to root disease and in their great ratooning power. POJ 105 promises to be equally resistant.’’


(101) Sugar Cane Varieties of Porto Rico. II. Jour. Dept. Agr. of P. R., V, 3, pp. 1–141; 1921. Corrects description of POJ 36 which he had earlier described as 56 & describes POJ 105. Notes POJ 213 as imported from the Argentine by this Station in 1921, but not tested.

EARLE, F. S., et al.


EASTERBY, H. T.

(103) 33nd Anul. Rept. of the Bureau of Expt. Stations, Queensland, pp. 1–58; 1922. Mentions POJ 36 & 213 as recently imported from Java to Bundaberg Station.

FAGALDE, LUIS M.

(104) Memoria del Banco de la Provincia de Tucumán, pp. 46–8; 1917. Estimates no. of hect. cane in Prov. of Tucumán at 75,446, of which POJ 36, 213 & 234 represent 66,487. Calculates yield of Creole (Rayada) at 15 tns. per hect. and the POJ canes at 50.

(105) Id., 1919, pp. 33–5. ‘‘For the crop of 1920 we can calculate that the whole 80,000 hectares in cane in the Province will be replanted with the best Java varieties . . . . If a few small plantings of the native canes remain they need not be taken into consideration, as they will not be of sufficient importance to exercise any influence on the general calculations . . . . The 112,289 hectares of Creole (Rayada) canes which existed in 1914 have now entirely disappeared.’’
FAWCETT, G. L.

(107) Producción de Caña de la Semilla. Rev. Tuc., V, pp. 451-2; Mar., 1915. In view of important results obtained in Tuc. with POJ seedling canes, points out importance of continued attempts to obtain seedling canes bred under Tucuman conditions, which author eventually succeeded in doing.

(108) Las Enfermedades de las Raíces de la Caña. Rev. Tuc., VI, pp. 37-8; Jun., 1915. Few root diseases occur in Tucuman. Concludes that importance of Marasmus has been over-estimated by cane pathologists, although undoubtedly causes occasional trouble. For control of root disease complex recommends planting of resistant varieties such as POJ 36 and 313.

(109) Algunas Descripciones Botánicas de las Variedades de Java y Otras Cañas. Rev. Tuc., VI, pp. 509-23; May., 1916. Valuable original descriptions, according to Jeswiet system, of POJ 234, 36, 213 & 105 (as Amba de Egipto).

(110) La Descripción de Variedades de Caña. Rev. Tuc., VII, pp. 351-3; Ene., 1917. Calls attention to importance of proper description and classification of cane varieties in order to avoid large losses to planters through the planting of inferior canes which look like proven better varieties. Reviews work along this line in Java by Soltwedel, Benecke, Kobus (the originator of the POJ canes) and latterly by Jeswiet.

(111) La Identificación de las Variedades de Java y Otras Cañas. Rev. Tuc., VII, pp. 424-31; Mar., 1917. As previous descriptions have seemed complicated to the planters, considers in this article only the simplest and most noticeable characteristics of the varieties.

(113) Notas. Rev. Tuc., VIII, pp. 81-2; 1917. Discusses recent demonstration of extreme susceptibility of H 109 to "eye spot" (Cercospora sacchari Van Breda de Haan) as an indication of care growers of POJ canes in Tucumán should take in reporting any unusual outbreak in their canes.

(114) Hojas Amarillas de Brotes de Caña. Rev. Tuc., VIII, p. 110; 1917. Short note on chlorotic condition of cane leaves, due to defective nutrition. "The Java POJ 36, being a variety with light green leaves, shows this chlorotic condition more frequently than the other Java canes."


(116) Enfermedades de las Raíces y de las Cepas de la Caña. Rev. Tuc., IX, pp. 97-102; 1918. POJ 36, 213 & 234, commonly cultivated in Tucumán, while relatively resistant to root diseases, do suffer to certain extent from their attacks. Considers POJ 36 most resistant of these three. Advises employment of good cultural methods & rotation of crops from time to time.


(118) La Obtención de Cañas de Semilla Produceda en la Argentina. Rev. Tuc., X, pp. 31-41; 1919. Discusses "the superiority of the canes introduced from Java over those formerly cultivated here" and mentions the plantation of POJ 36, 213 & 234 made by Rosenfeld in the northern province of Jujuy with the object of obtaining flowers—"the first plantation of cane made by the Expt. Sta. outside of the Province" (of Tucumán). States that the flowers of POJ 36 & 213 are pollen-sterile, those of POJ 234 fertile to very small extent and POJ 105 probably fairly fertile.

(119) La Enfermedad de las Rayas Amarillas en la Caña. Rev. Tuc., X, pp. 46-8; 1919. "In every case the oldest infected leaves of the Java canes possess a dark green color and appear completely sound and normal, not showing the white and yellow areas characteristic of the older infected leaves of other varieties. This fact indicates that the Java canes have a certain degree of resistance to the disease. The yields of the Java canes heavily attacked by Mosaic have been very satisfactory indeed."

(120) Notas Adicionales sobre las Cañas Criollas. Rev. Tuc.,
(121) Notas sobre la Extirpación del Mosaico de la Caña. Rev. Tuc., XI, pp. 74–6. 1920. "The Java cane falls into the class which does not seem to suffer from the infection."


(123) Notas sobre la Clasificación de la Caña Morada Criolla. Rev. Tuc., XII, pp. 125–7; 1922. Shows that purple creole cane of Tucumán is distinct from Black Cheribón of Java, parent with Chumee of POJ 213, which he states is "perhaps the best variety in the Province."

(124) Enfermedades de la Caña de Azúcar en Tucumán. Rev. Tuc., XIII, pp. 1–46; 1922. Mentions plant of POJ 36 & 213 as susceptible to top rot & POJ 234 both as plant and ratoons. POJ 36 apparently least affected. Considers POJ 36 also most resistant of Java canes to Mosaic, POJ 105 in intermediate grade and the 213 most susceptible. All four resistant to root rot. Discusses windrowing expts. with POJ 36 & 234.

(125) La Desinfección de la Caña por la Calefacción. Rev. Tuc., XIII, pp. 205–6; 1923. Interesting rept. on results from expts. to determine effect of water at from 48 to 50 deg. C. on Mosaic infection in POJ 213. "The procedure, as can be seen, had an entirely negative effect on the Mosaic. The temperature which is capable of destroying the eyes appears to be close to 50 degrees C." X-ray expts. gave negative results also.

(126) El Mosaico de la Caña de Azúcar. Rev. Tuc., XIV, pp. 5–8; 1923. "Some varieties do not seem particularly affected by the disease. The varieties POJ 213 & 36 . . . are notable in this respect . . . . Despite their heavy infection with Mosaic they are still cultivated with very good results. The majority of the other varieties which have been tried here . . . have proven to possess very little resistance to the disease, for which reason their cultivation has been discontinued."

(127) Algunas Notas sobre el Efecto del Frío sobre las Yemas de la Caña. Rev. Tuc., XIV, pp. 67–73; 1923. An exceptionally interesting and original study of the effect of freezes on the eyes and heart buds of cane, POJ 213 being used in the expts. with controlled temperatures of various intensities and durations below the freezing point. Concludes that (1) a temperature of around—3 degrees C. is required to kill the mature eyes, (2) the sprouts are less resistant to cold than
mature eyes, 1½ to 2 degrees C. below zero, according to their stage of development, destroying them, and (3) the black color on the interior of the heart bud frequently found after low temperatures is due to prolonged exposure to temperatures somewhat above those required to kill the cane—for example, several hours’ exposure to a temp. around 1½ degree below zero Centigrade.

(128) La Enfermedad de las Raíces en la Caña de Azúcar. La Hacienda, Buffalo, N. Y., XIX, 6, pp. 174-5; Jun., 1924. “The planting of sugar cane of the varieties of Java in the infected soils will be found very advantageous.”

GARBIN, GEROLAMO

GARCÍA, TUBAL C.
(130) El Costo y la Ganancia de Azúcar. Sugar, N. Y., XXV, 8 & 9, pp. 446-7 & 506-7; Aug. & Sept., 1923. A thesis presented to the Faculty of Economic Sciences of the U. of Buenos Aires, in which the author analyses cheaper cost of sugar production in Tucumán, through use of POJ seedlings.

GRUNAUER, L.

GUZMÁN, ALFREDO
(132) La Estación Exptl. y su Utilidad. Rev. Tec., III, pp. 243-7; Nov., 1912. Letter from Pres. of the Board of Tec. Sugar Expt. Sta. to the Secretary of the Buenos Aires “Sugar Center” calling attention to work of Expt. Sta. “Consider only the results obtained from some of the Java canes and you will recognize that we have a perfect right to feel very optimistic.”

(133) La Cuestión Azucarera. “La Nación” de Buenos Aires, 27 Oct., 1916. An interview with the Pres. of the Tec. Agr. Expt. Sta. Board. “Happily, and thanks to the investigations carried on by the provincial expt. sta. for many years past, varieties have been found and proven which seem to combine all the desired conditions, as regards agricultural as well as industrial yield, and this year the sugar men and planters have intensi-
fied their efforts to such an extent that practically all
the cane fields which were in bad condition are now
replanted with these varieties."

Hall, J. A.

(134) Los Problemas Azucareros. El Mundo Azucarero, Ha-
mana; Sept., 1914. Reviews work of expt. stations of
Tucumán, Perú, Jamaica, Cuba and Louisiana, which
he had recently had occasion to visit. Speaking of
promising results with POJ canes in Tucumán, con-
cludes: "The studies and experiments already realized
in the Tucumán Expt. Sta. give promise of very shortly
reimbursing the sugar manufacturers and planters for
all the expense involved in the establishment and main-
tenance of that institution—and not only reimburse
the funds invested but pay a handsome dividend on
the investment . . . Such results can be looked upon
with justifiable pride by the experts of the Station."

(135) Observaciones acerca de los Efectos de la Brotación Pre-
matura de la Caña de Azúcar. Mundo Azucarero; 1914.
Review of work carried on at Tucumán Sugar Expt. Sta. along this line. Gives complete analyses of
POJ 36 & 234 during crop of 1913.

Hamakers, Carlos R.

(136) Plantaciones o Criaderos de Semilla de Caña en la Mon-
the establishment of seed gardens in Tucumán foot
hills, similar to those employed in Java, in order to
obtain selected cane each season for the plantations of
the POJ canes then giving such promising results in
the Province.

Hays, W. M.

(137) Informe sobre la Estación Exptl. Agrícola de Tucumán.
Rev. Tuc., V, pp. 139-50; Sept., 1914. Reports, as
Consulting Technologist to Tucumán Government, on
past and future work of Tuc. Sugar Expt. Sta. and its
relation to recently founded University of Tucumán.
Points out remarkable results already obtained from
the POJ canes and discusses usefulness of various
distinct lines of investigation to the Province. App-
ends list of 117 projects under investigation at Sta.

Jeswiet, J.

(138) Beschrijving der soorten van het Suikerriet. Med., VI,
7 & 8; 1916. Probably the work of most importance
to date on technical descriptions of cane varieties,
being extensive and detailed. Follows more or less
same system of description employed by his predeces-
sors. Soltwedel, Beinecke & Kobus, this being based on
vegetative characteristics of plant cane 4–6 months old or the upper part of mature canes.

(139) Id., No. 12; 1917. Publishes detailed original descriptions of POJ 36 & 213, with illustrations. A most useful contribution to literature of this subject.

JOHNSTON, Jno. R.

(140) The Mosaic Disease of Sugar Cane in 1923. Published by the Agr. Research Dept. of the United Fruit Co.; pp. 1-35; Dec., 1923. "Java 36 (POJ) is also highly resistant."

JONES, T. H.


KERR, E. W.

(142) Fiber Content of Sugar Cane. Sugar, N. Y.; 1915. Calls attention to importance of high-fiber canes for furnishing fuel in subtropical countries. Gives analyses of POJ canes in Tucumán and comments on high fiber content of all the promising ones. Considers the adoption of these canes a step forward, not only agriculturally but mechanically.

KOBUS, J. D.

(143) Vergelijkende proeven omtrent geelstreppeziekte. Med., No. 12, pp. 319–42; 1908. First practical studies of Mosaic Disease by the man who by means of crosses produced the POJ seedlings. Kobus arrived at the conclusion that the disease manifests itself with varying virulence, citing the example of Java 247 (B), which is stunted and weakened by the disease, while POJ 36 represents the other extreme of high resistance. Often the latter did not seem to undergo any decrease in yield on acct. of Mosaic, although this declaration does not harmonize with a table of yields which he presents in this paper.


KOBUS, J. D., et al.

(145) La Caña de Java. Rev. Azucarera, Buenos Aires, XIV, pp. 182–4; Sept., 1916. An interesting and almost forgotten little fragment of history of first introduction of the Java seedlings into Tucumán, first suggested to Gov. Luis Nougués by Dr. Kobus while Director of the Expt. Sta. in Java. Extracts from several of Kobus' letters from 1907 to 1909, together with those
from Gov. Nougues, are given. In speaking of this series of canes, Kobus wrote: "We have in our exp. fields a series of new cane varieties from which I anticipate a considerable increase in Java sugar production."

Marotta, F. Pedro

(147) El Proteccionismo a la Industria Azucarera por la Ley 8877. Bol. del Ministerio Nacl. de Agr., Bs. Aires, XX, 7 & 8; 1916. Comments on importance of Rosenfeld's "Ten Best Canes in Tucumán." (166). "The canes recommended, then, are the Java POJ 36, 213, 234 & 139, which give good yields and are early maturers, with the exception of the 139, which is a bit late. All have good purities and mg. value."

May, D. W.

Natta Maglioni, José V.
(149) Fomento Agrícola del Chaco. Depto. Nacional de Agra., B. Aires; 1917. "The Java varieties are very much in demand in Tucumán and we fear that little seed can be obtained for use outside the province, since they are destined to totally supplant the Creole canes in that province on account of their outstanding good qualities definitely demonstrated experimentally in that sugar region."

Nougues Hnos. et al.
(150) El Cultivo de Nuevas Variedades de Caña. Revista Azucarera, Buenos Aires; Nov., 1912. Various replies to a questionnaire sent out by the "Buenos Aires Sugar Center" asking for reports on results of expts. with new varieties. It is interesting to note that only a few centrals replied that they were cultivating any material extension of the POJ canes at that time.

Padilla, Ernesto E.
(151) Governor's First Message to Tucumán Legislature; April, 1913. Referring to promising results from POJ canes in the Agr. Expt. Sta., says: "Results of the experiments indicate that we are at the initiation of a great evolution in our agricultural industry which will increase our yields and greatly reduce the cost of the manufactured product."
(152) Final Message to Legislature; 2nd April, 1917. "Thanks to the foresight of Gov. Nougues in 1908, seconded ably by the initiative of some of our most enterprising citizens, and later by the work of the Expt. Station, it has been possible to largely increase the plantations of the Java varieties, which promise to give yields double those obtained from the Rayada cane on the same area."

(153) Debate on Sugar Tariffs. Argentine Cong. Record; 1917. By planting the Java canes the cost of production is considerably reduced, since these canes develop more quickly and require less cultivation and, consequently, less expense than do the other varieties generally cultivated."

(154) La Cuestión Azucarera. Arg. Cong. Record; 11th Aug., 1920. "The Argentine is the only country in the world which, after almost entirely losing its canefields through a grave agricultural crisis, has recovered from such a blow in so short a time. The industry has come to life again through the employment of the Java canes studied in its experiment station, wisely provided by the intelligent intuition of Governor Luis Nougues."

PADILLA, MIGUEL M.

(155) La Crisis del Azúcar. La Prensa, Buenos Aires; 5th Dec., 1916. "As regards the agricultural phase of the problem, the Argentine industry is at present in a state of evolution. When symptoms of degeneration began to be noted in what is known as the Creole cane, which is the variety which has always been cultivated in this country, the planters began to replace this old variety by new ones from Java, the agricultural and industrial yields of which have turned out to be about double those of the native cane.

PAIGE, R. L.


(157) Notes on Some Imported Cane Varieties in Porto Rico. Facts about Sugar, XV, p. 420; 1922. Reports a yield from Guánica of 38 tons per acre for first ratoons of POJ 36 in 1922, with 15.2% sucrose in juice.

PEÑA, SOLANO

(158) Industria Azucarera; Realidades y Esperanzas. Rev. Tuc., III, pp. 584-6; May, 1913. Calls attention to low field yields in Tucumán as compared with other sugar-producing countries and predicts doubling of Tucumán yields as the Java POJ canes are extended.
over province. This prediction was realized within five years.

PRINSEN-GEERLligs, H. C.


(160) Tratado de la Fabricación del Azúcar de Caña. Published by J. H. de Bussey, Amsterdam, pp. 1-337; 1910. Translation of (159) by Dr. Nicolás van Gorkum, Engineer in the service of the General Sugar Society of Spain.


REPETTO, DEPUTY

(162) Sugar Debate. Argentine Cong. Recd., 24th Jan., 1917. Quotes Rosenfeld on comparative productivity in Java and Tucumán, giving figures on area of POJ canes planted in the latter and time necessary for complete renovation with these of Tucumán cane area.

ROSEN Feld, ARTHUR H.


(164) El Trabajo de la Estación. Rev. Tuc., I, 9, pp. 44-7; Feb., 1911. “At the present time the Station is experimenting with 211 varieties of sugar cane from Louisiana, Barbados, Cuba, Porto Rico, Demerara, Java, Spain, Brazil, Argentine and other countries.”


(167) La Caña Java POJ 228 Rev. Tuc., III, pp. 139-42; Sept., 1912. Critical exp. comparison of POJ 228 with 36, 213 & 234. “POJ 228 was inferior in every way to the other varieties—in chemical analysis as well as in yield of cane.”

(168) The Most Promising Varieties of Cane under Trial at
the Tucumán Expt. Station. I. S. J., XVI, pp. 12–23; 1914. Contains in English practically the same subject matter as (166).

(169) Las Cañas de Java en la Estación Experimental Agrícola. La Gaceta, Tucumán; May., 1914. Comments on breakage of a mill roll said to have been due to high fiber content of POJ 234 being ground at time. "It is positively ridiculous to take the attitude that these high-fiber canes cannot be successfully ground in the modern Tucumán centrals . . . The high fiber content of some of these canes does not in any sense constitute an obstacle to their employment . . . In a simple mechanical problem such as this is Tucumán ought to be able to find the same solution which has been encountered by any other sugar country." Gives fiber content of POJ 36, 213 & 234 and shows that many Java mills grind continuously canes with higher fiber content than any of these.

(170) Maduración de las Cañas Extranjeras. Rev. Tuc., IV, pp. 527–9; 1914. Analyses made in April, 1914, some two months before initiation of crop (corresponding to October in P. R.), showed good stages of maturity for some of the most promising POJ canes. POJ 234 again demonstrated itself a very early matuer with 86% purity and 14% suc. in juice. POJ 36 showed 80.4% and 13.8%. "The Java 234 & 36 (POJ) seem to possess in high degree the characteristic of early maturity which is so outstanding in our native canes."

(171) Discurso en Reunión de Plantadores, 14 May., 1914, Rev. Tuc., V, pp. 1–4; Jun., 1914. Calls attention to need of caution and patience in variety expts., as well as to positive danger of jumping at conclusions from a few years' results. "This point should be clearly demonstrated by the fact that, almost without exception, the new varieties of cane which gave us the most promising results the first year of their trial are not today, after four years of careful and accurate investigation from every standpoint . . . those we can recommend for replacing the native canes."

(172) Las Cañas de Java y su Contenido de Sacarosa. Rev. Tuc., V, pp. 199–207; Oct., 1914. Various comparative analyses of POJ 36, 213, & 234 with native canes in Tucumán during 1914 crop. POJ 234 appears in one analysis from Expt. Sta. with 20% sucrose in juice and in another from San Pablo with 19 1/2%. "The analyses of the Java canes have turned out relatively as good as those of the canes of the country."

indicate that Mosaic Disease has so weakened cane that it does not respond to fertilization.


(175) Resultados de Cinco Años de Experimentación con Variedades de Caña. Rev. Tuc., VI, 6, pp. 231-78; Nov., 1915. "POJ 36, on account of the characteristics already discussed, appears to be the cane destined to replace the Creole (Rayada) cane in our Province, the POJ 213 & 234 . . . . following in the order of their mention."


(177) Maduración de las Cañas Extranjeras. Rev. Tuc., VI, 434-6; Mar., 1916. Analyses of POJ 36, 213 & 234 made latter part of April, 1916. "The analyses . . . show . . . very respectable percentages of sugar in the juices of these varieties which we now know to be of early maturity and enable us to predict for the coming crop at least normal purities."

(178) Identificación de las Cañas de Java. Rev. Tuc., VI, p. 437; Mar., 1916. Planters who desire to propagate POJ 36, 213 & 234 should be certain that seed they obtain is of these varieties and if in doubt should send specimens to Expt. Sta. for identification.

(179) La Caña Kavangire. La Gaceta, Tucumán; 15 Abril, 1916. Calls attention to confusion amongst certain planters in identification of Kavangire (Uba) & POJ 234. "The planter who purchases Uba thinking that he is obtaining POJ 234, paying the price demanded for the latter, is losing money."

(180) La Estación Experimental Agrícola de Tucumán en el Centenario de la Independencia Argentina. Rev. Tuc., VII, pp. 1-82; 1916. "The value of these investigations has been recognized both within and without the country, not the least important of these being those which have enabled the Station to recommend to the planters a series of cane varieties which give far superior results to those commonly employed, as well as the best methods of planting, seed selection, cultivation, etc."


(182) Some Remarks on the Tucumán Sugar Industry. Published by American Commercial Club, Buenos Aires;
Dec., 1918. An address before the Comm. Club, covering more or less same ground as (181).

(183) Estudios Gráficos de las Diversas Variedades de Java en las Colonias de Santa Ana. Rev. Tuc., X, 2, pp. 57-8; 1919. "According to yields and analyses there is little to choose between the 36 and 213, the former probably being preferable only on account of its erect growth, small amount of lodging and easier stripping."

(184) La Estación Experimental de Tucumán; Retrospecto de sus Trabajos. Revista Azucarera, Buenos Aires, XVII, pp. 305-9; Oct., 1919. "In the present crop 90% of the cane ground in the Province is of the Java varieties."

(185) What the Tucumán Expt. Station has Done for the Argentine Sugar Industry. I. S. J., XXI, pp. 488-93; 1919. Covers in English largely the same ground as (184).

(186) Some notes on the Tucumán Sugar Industry. I. S. J., XXI, pp. 606-8; 1919. Brief description of climate and short history of sugar industry in that Province up to the time of the replacement of the commonly grown canes by the POJ.

(187) Kavangire—Porto Rico's Mosaic-Resisting Cane. I. S. J., XXII, pp. 26-33; 1910. Considers that thinness of Uba and POJ varieties does not constitute an insuperable objection to their adoption. "The thin, rapid-growing, but not at all aesthetically appearing POJ 36 & 213 . . . have been universally adopted in Tucumán, only a few rows of native cane being seen today, carefully guarded and nursed as an invalid might be by the friends of his youth."


(190) Power: Cultivation of Sugar Cane. I. S. J., XXII, pp. 499-501; Sept., 1920. Tractor cultivation of POJ 36 & 213, with a number of cuts of methods and machinery employed.

(191) The Question of the Distance between Cane Rows. I. S. J., XXII, pp. 558-65 & 629-35; Oct. & Nov., 1920. A rather detailed study of results obtained in various parts of the world, including those obtained at the Tucumán Expt. Sta. with native canes and with POJ ones later employed as basis of experimentation.

Ana with POJ 36 & 213 on very large scale, these results covering over a thousand acres.

(193) The Question of the Distance Between Cane Rows. I. S. J., XXIV, pp. 72-6; 1922. Bringing (191) up to date.

(194) Lo que la Estación Exptl. de Tucumán ha Hecho por la Industria Azucarera. La Hacienda, Buffalo, pp. 291-6; Oct., 1922. History of the work of the Tucumán Station with varieties and calculations of money value of the substitution of the native canes in that Province by the POJ varieties recommended by the Station.

(195) La Caña Kavangire. La Hacienda, Buffalo, pp. 131-4 & 169-72; May & Jun., 1923. Stresses point that, just as high fiber content of POJ canes in Tucumán did not prevent their universal adoption there, this factor should not weigh too heavily in the balance against the use of Uba cane in Porto Rico.

(196) A Beneficial Aspect of the Sugar-Cane Mosaic Disease. I. S. J., XXVI, pp. 191-5; Apr., 1924. "In the heaviest-infected districts along the west and northwest coast (of P. R.) ... the tolerant POJ 36, 105 and 213 are being employed on a large scale with most promising results."

(197) Aspecto Beneficioso del Matizado de la Caña de Azúcar. La Crónica Comercial y Financiera de Cuba, I, 5, pp. 7-9; May 1924. Spanish translation by C. A. Figue- roa of (196).

ROSENFELD, ARTHUR II., & BARBER, T. C.


(199) El Gusanito Chupador de la Caña de Azúcar. Rev. Tuc., IV, pp. 229-366; 1913-14. "The moth-borer (Dia- traea) can be considerably reduced in its damage ... by gradually substituting the harder and thinner varieties of cane ... such as some of the Java canes in which borer infestation is always low."

SÁNCHEZ, JULIO

(200) Informe del Agrónomo Regional. Ministerio Nacional de Agricultura; 1917. Rept. on visit to Centrals "Esperanza" & "Ledesma" in the Prov. of Jujuy, consider- ably north of Tucumán. From "Esperanza" cites following yields of cane per hect.: Rayada 37/2; POJ 36 & 213, 90; POJ 234, 75. Recommends similar trials at "Ledesma".
Informе del Agrónomo Regional al Min. Nacl. de Agra., Buenos Aires. Industria Azucarera, Bs. Aires, XXIX, 365, p. 153; 1924. Regional Agronomist for the Northern Province of Jujuy reports that cane now grown in that province consists 'almost entirely of Java canes.'

Simois, Domingo L.
(202) Sobre la Caña Tucumana. Argentine Cong. Rec.; 1917. During debate on sugar tariff Senator Padilla of Tucumán quoted from letter from Director Simois, of the National Sugar School in Tucumán, to Sen. Camanéo, as follows: "We recommend... the cropping... of... large extensions of Java cane... We have been able to establish yields of 100 tons per hectare."

Smith, Erwin F.
(203) Bacteria in Relation to Plant Diseases, Vol. III, p. 72; 1914. Mentions stimulus of Sereh ravages to production of POJ seedlings.

Snyder, W. P.
(204) Report of Assistant in Plant Breeding. Rept. P. R. Agr. Expt. Sta. for 1919. Repts. germ. of seed from POJ 36 & 234 as very poor and the damage caused by 'abundant' occurrence of Mosaic on POJ 36 as 'slight' & POJ 234 as 'very serious.'

Snyder & Saldana
(205) Report of the Assistant in Plant Breeding & Horticul- ture. Rept. of the P. R. Agr. Expt. Sta. for 1921, pp. 16-18; Sept. 1922. The only mention found anywhere of seedlings of POJ 36, which is generally found infertile.

Stevenson, J. A.

Tempany, H. A.
(207) Experiments with Varieties of Sugar Cane, 1920-22, Together with a Summary of Results from 1917 to 1922. Mauritius Dept. Agr., Bull. 30, Gen. Ser.; 1924. As results of expts. with both plants and ratoons during this period, the following varieties are picked out as more or less suitable for cult. on some scale: D 109, B 6308, B 6450, POJ 213 and 12 local varieties.

Teran, Juan B.
(208) La Universidad y la Vida. Lectures of the Rector of the Univ. of Tucumán collected in book form, pp. 1-50;
1921. "We have had in Tucumán some very eloquent experience as to the significance of technical work in Agriculture which serves as a basis with which to gauge its vast possibilities; 3,500 acres of new varieties (POJ 36, 213 & 234) of proven canes will in four or five years more entirely take the place of the old varieties. This transformation will probably signify the cutting in half of the cost of our raw sugar material."

Van Dine, D. L.
(209) Damage to Sugar-Cane Juice by the Moth Stalk-Borer. P. R. Sug. Planters' Expt. Sta., Circ. 1, pp. 1-11; 1912. Estimates direct loss in sugar per acre from reduced value of juice due to borer attacks at 670 lbs. per acre for P. R.

Wale, J. H.
(210) Los Efectos de las Recientes Heladas sobre la Caña de Java. Rev. Tuc., VI, p. 12; Jun., 1915. "It has always been recognized that the Java canes POJ 36, 213, & 234 are more resistant to the effects of frosts than are the native canes."

(211) Informe de las Subestaciones, Año 1915. Rev. Tuc., VI, pp. 279-96; Dec., 1915. In Monte Bello the second ratoon crop showed 8 tons cane per hect. for the Rayada, 61 tons for POJ 36, 53½ tons for POJ 213 & 33 tons for POJ 234. In San Pablo as second ratoons the Rayada gave 40 tons; the POJ 36 gave 101, the POJ 105 gave 69 tons, the POJ 213 gave 70 tons and the POJ 234 gave 69 tons. The POJ 105, however, showed but 8.69% sucrose in juice, while the POJ 234, giving the same field yield, analyzed 14.26%. In Aguñares POJ 213 showed up best of POJ varieties tried as first ratoons with 74 tons cane and almost 3 tons sugar per hectare in a very unfavorable year.

Westerkamp, J. F.
(21) Las Cañas Extranjeras en Jujuy. Rev. Tuc., V, pp. 103-5; Ago., 1914. Two interesting letters giving data on an expvl. pltg. of POJ 36, 213 & 234 at Ingenio Esperanza in the northern province of Jujuy, Argentine. "These canes possess the valuable characteristic of very rapid growth even with a small amount of irrigation water and appear to be well adapted to the drier lands."

Wilbrink & Ledebour
(213) Bijdrage tot de Kennis van der Gelestrepenziekte. Med., No. 39, pp. 433-95; 1910. Interesting statement that seedlings obtained from seed-heads of infected canes are clean.
ZERBAN, F.
(214) Advertencia Respecto a la Importación de Nuevas Variedades de Caña. Rev. Tuc., I, 1, pp. 16-7; Jun., 1910. Mentions early introduction of POJ canes into Tucumán & calls attention to danger of introducing pests and diseases if importations are not properly inspected by competent authorities.

ZERBAN, F., & ROSENFIELD, ARTHUR H.